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Project Management: 3 Packages Make Your Job Easier

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Undocumented Windows: What Microsoft Didn't Tell You

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FEBRUARY 11, 1992 THE INDEPENDENT GUIDE TO PERSONAL COMPUTING VOLUME 11 NUMBER 3

486/33s

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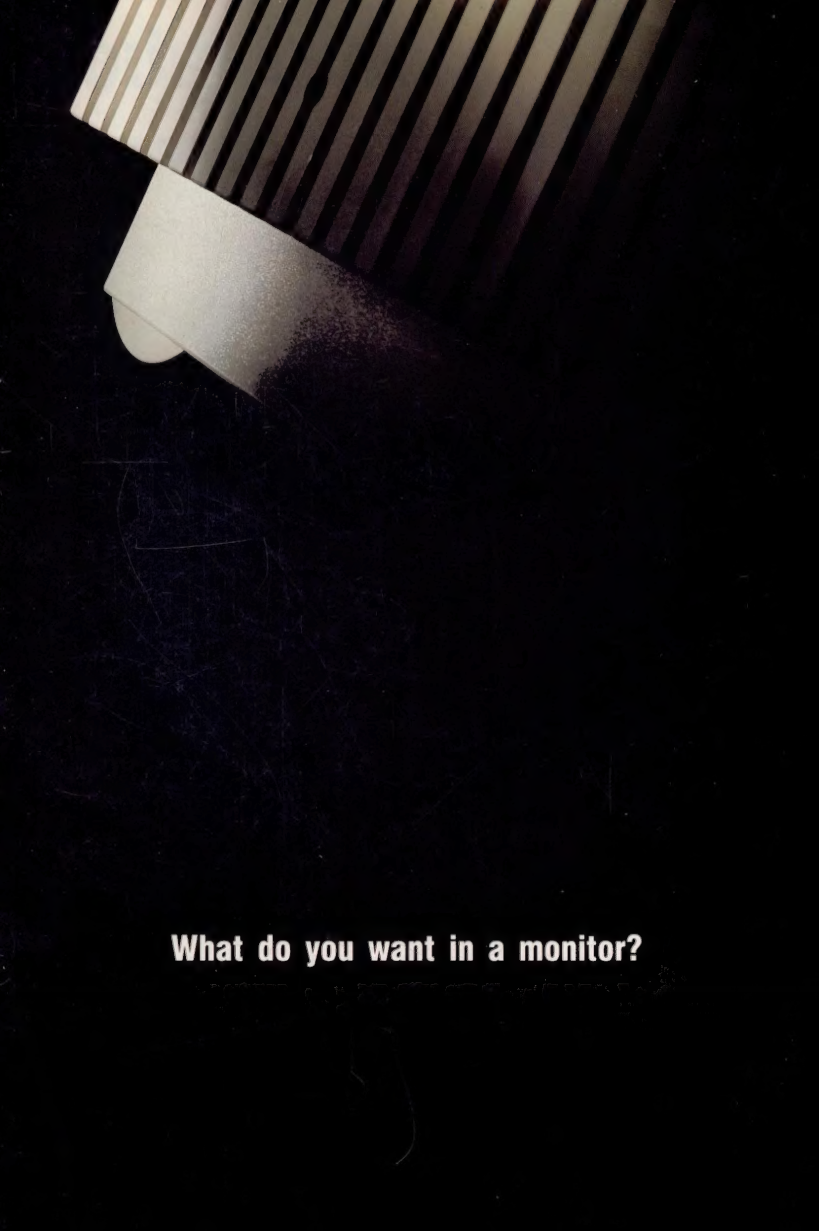
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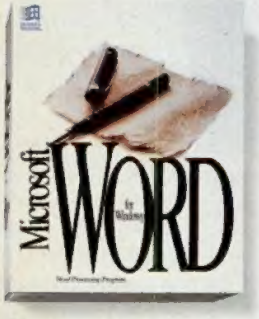

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Inside

Twenty-two times a year a new issue of *PC Magazine* comes out. A typical issue averages between 150 and 175 editorial pages, covers about 100 products, and includes as many as 100,000 words. Making sure that the facts we report are right—including the ones in the preceding sentence—can be a monumental responsibility. One mistake about the features or capabilities of a product can harm a struggling company or frustrate a reader who bought that product for a function that doesn't exist.

Considering the volume of products and the number of details we cover, *PC Magazine* has done remarkably well in maintaining a high standard of accuracy.

But this past summer, we decided to raise that standard another notch. We hired Dianne H. McDonald as our assistant managing editor for research. Her assignment was to create a formal system to fact-check the articles that appear in this magazine and to manage the staff that would implement this process. The new system went into place three issues ago, and we think you'll appreciate the new level of factual correctness she has brought to *PC Magazine*. Dianne came to *PC Magazine* from *Newsweek*, where during 13 years she rose from a secretarial position to the status of associate editor supervising editorial business research. She acquired a reputation for a relentless pursuit of the truth and an ability to transfer that enthusiasm to her staff.

Research staff, from left to right, top to bottom: Berlin, Gunn, Flanagan; Williams, Cline, Reynolds, Giebel; Grimes, McDonald, Thomas.

In our new system, she has pulled together the talents of librarian Thomas Giebel, library assistant Dolores Williams, editorial researchers Eric Berlin, William Flanagan, Bradley Grimes, Angela Gunn, and Susan Thomas, and editorial trainees Camille Cline and Lawrence Reynolds. They work closely with the associate editors, the PC Labs project leaders, and the many vendors whose products are mentioned. They can be called on to check everything from the spelling of a product name to how many fonts are built into a printer.

Fact checking can be a lot more exciting than you might think. In the fast-changing world of computers, the truth can be pretty elusive. Trying to pin down the name of a new product, one of our researchers got three different spellings from three different company officials. They finally asked our researcher to pick one and said they'd abide by her decision.

Researchers check the telephone numbers listed in our stories by actually dialing them. Recently, one intrepid truth-seeker dialed a number listed as the support line for a software product. He ended up on-line to *New York* magazine's sizzling "Strictly Personals" hot line.—**Joel Dreyfuss** ■

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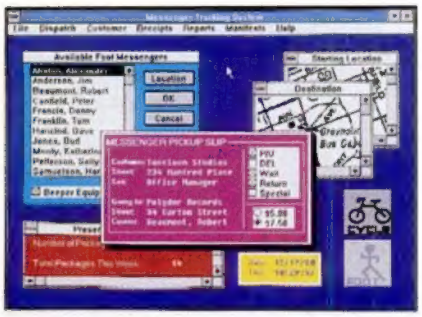

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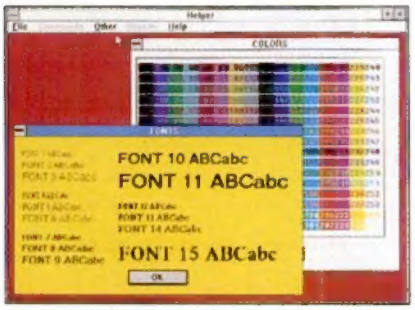

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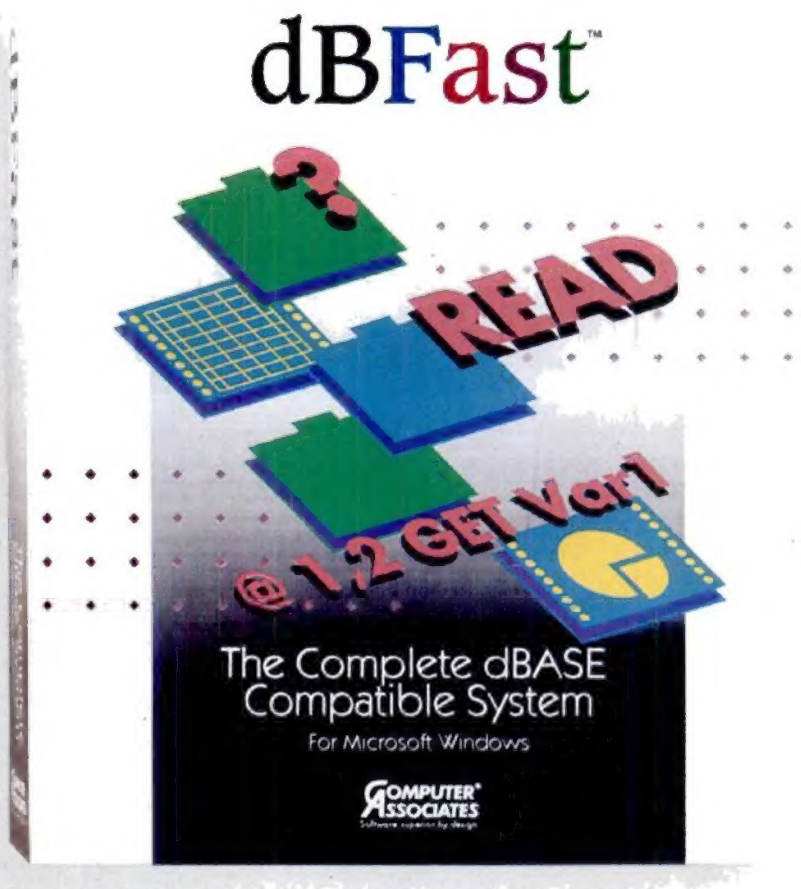

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PC MAGAZINE®

February 11, 1992

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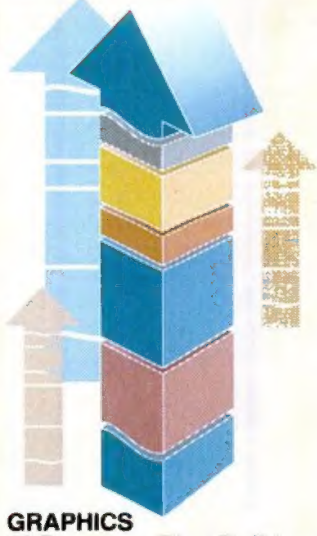

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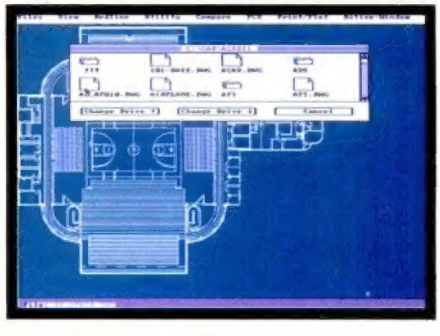

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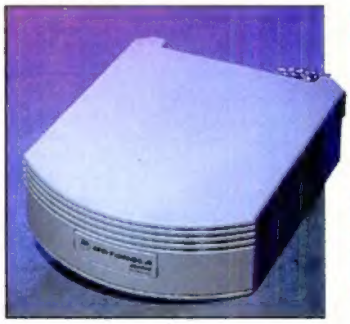

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Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, shorter bars indicate faster products (less time to complete a task). Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25es.

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CIRCLE 011 ON READER SERVICE CARD

Letters

DVORAK VS. SCIENTIFIC AMERICAN

In response to John C. Dvorak's "A Crock is a Crock" column (November 26, 1991) about *Scientific American's* article on "Communications, Computers and Networks": Mr. Dvorak, this is *Scientific American,* not *The Wall Street Journal.* People think in much longer terms about the potential benefits of the ideas discussed here than just the next fiscal quarter or year.

I read your magazine regularly and I realize that most computers are used in business settings, and this dictates the type of articles that appear. But the Internet, TCP/IP networking protocols, X-Windows, and the like are changing the way scientific research is done in this country and around the world. Whether one uses the term "revolutionizing" or not is a question of semantics and opinion, but nevertheless the benefits are real and very substantial.

Bill Kath
Evanston, Illinois

John C. Dvorak misses the point again. The articles in the September issue of *Scientific American* are not just opinion pieces, they are visions of the future. There is no mention of New Age thinking in them.

The infrastructure to change our society is already here. It is called the Internet. The concept of the "Knowbot" is idealistic, but that doesn't make it "dopey." Also, what is this hangup with ISDN? He talks about how it should be required by the government but yet does not want the government involved in technology development. Let's get real. The government must be involved so that everyone can have the opportunity for access to the next information superhighway.

Wilfred E. Drew
Cortland, New York

FREE SYSTEM RESOURCES OR FREE IRELAND?

I'm sure that WINFSR, Fran Finnegan's program that monitors Windows 3.0's Free

Once again, John C. Dvorak has gotten a rise out of our readers.

System Resources (FSRs), is a useful utility (Windows column, November 12, 1991). But I'm not so sure that it was necessary to use the program as a vehicle for Finnegan's "Free Ireland" message.

One of America's most cherished virtues is the right to free political speech, and computer programs such as Finnegan's are a form of speech. I wonder, however, how many other Windows users will object to the prominent use of the Irish flag and the word "Free" three times in the sample screen shot—especially in an icon that the author recommends be kept on-screen at all times!

Perhaps Finnegan should provide a detailed explanation of how to change the icon, using the appropriate resource compiler or editor. That way, WINFSR could be used with a clear conscience by all Windows users, not just those who support the overthrow of the government of Northern Ireland.

Douglas E. Ewell
Placentia, California

I find it interesting that the icon used in WINFSR looks remarkably like the flag of Ireland, which makes the icon read "Free Ireland". It could be seen in some places (London comes to mind) as a dangerous statement, to say the least.

I am not writing to criticize Fran Finnegan's position; I find it difficult to take sides in any conflict where innocents are killed regularly. However, I do question the fact that the editors can allow a potentially explosive political statement like this to get into the magazine and onto PC MagNet.

Also, nowhere in the article is there a mention of what C compiler should be used with the source code.

Stephen J. Putman
Sacramento, California

It was neither the author's nor *PC Magazine*'s intention to make a political statement. The word Free refers to Free System Resources. However, we have changed the icon and posted a new version of WINFSR on PC MagNet. You can compile WINFSR with Microsoft C 5.1 or later, or Borland C++ 2.0 or later.—*Ed.*

AN APPLE IN THE FUTURE

I feel that Michael Miller's comments about the Apple/IBM partnership ("Ten Years of Predictions," November 12, 1991) are misleading. Making fun of Apple for marching off the cliff with IBM ignores the fact that the Apple of today is not the same Apple that created the "lemmings" or the 1984 ad spots you alluded to.

That Apple Computer was run by a brash, inspired young man named Steve Jobs, who wasn't afraid to air his strongly held views on the subject of personal computing's impact on the people who use it. Today's Apple Computer is run by a smooth Ivy League corporate diplomat who gained his reputation selling soda pop. Of course John Scully steered Apple off the cliff; he had already jumped off years before.

If Apple/IBM screw up the Mac in this unholy marriage, I'll do what classic car

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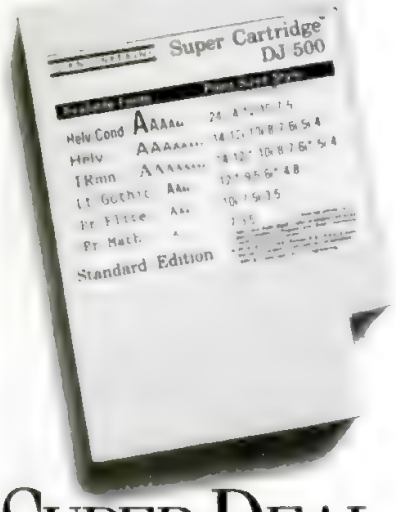

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CIRCLE 325 ON READER SERVICE CARD

Letters

lovers have done for years: Buy an old model and make it work.

David MacNeill
Sacramento, California

A REMEMBRANCE OF LOGITECH'S PAST

It is ironic that your Editors' Choice award for the Logitech hand scanner appears in the same issue (November 12, 1991) in which John C. Dvorak berates manufacturers for discontinuing support for older versions of their products. You're right, Logitech certainly does build great scanners and its *Ansel* software is a great scanner utility. Except, because of interrupt conflicts with the older scanner board, in many common circumstances *Ansel* simply won't work with the older ScanMan. Meanwhile, Logitech has never even bothered to issue a software upgrade for the older ScanMan that's accessible by Windows Standard or Enhanced modes.

This policy bodes ill for anyone expecting that their brand-new Editors' Choice scanner is going to be supported next year when something else hits the market. Still, if Logitech refuses to support its own product, end users can purchase ZSoft's *Publisher's Paintbrush* 2.0, which supports the old Logitech scanner just fine under Windows 3.0—with no interrupt problems.

Jim Nollman
Friday Harbor, Washington

HARDWARE HANDICAPPING: AN OLD TRICK

In response to Mr. Cerullo's letter about Intel's crippled 486SX chip (Letters, October 29, 1991): Mr. Cerullo is apparently a newcomer to the computer industry. IBM has been using the "cripple and sell it cheaper" technique since at least 1965. IBM just gives a new model number to its "handicapped" hardware instead of adding the term "SX" to the old, like Intel did. I'm sure Intel would like to take credit for this stroke of genius, but let us render unto IBM what is IBM's.

Since the computer industry has been using this "new marketing" strategy for more than 25 years, Intel's 486SX chip is certainly not any indication that our computer industry is going to be taken over by the Japanese.

Bob Braswell
Albemarle, North Carolina

IBM: TRUE STORIES

I am somewhat bemused by your portrayal of IBM of late. It would appear that IBM can do no good in your eyes. Your readers receive the impression that IBM produces high-priced, mediocre products and provides only an acceptable level of service.

I live in a somewhat isolated area of the North Carolina mountains, and recently my IBM L40 SX laptop needed its LCD screen replaced. I telephoned IBM requesting service. That same day an IBM service representative arrived at my door to pick up the laptop. The next day he delivered the laptop back to my door—completely repaired. I was astounded.

Sometimes one must give a company its due, and my experience with IBM indicates that IBM is not only listening, but is bending over backward to provide excellent products and superb service to its customers. Bravo IBM!

Eric K. Morley
Banner Elk, North Carolina

DO-IT-YOURSELF TECH SUPPORT

It's clear from reading your Letters column that there are many crybabies out there who require an inordinate amount of hand-holding. One recent letter expressed a reader's dissatisfaction with the response he received from Microsoft Corp. after he mailed them a three-page letter concerning a "product defect."

It would be easy to pick up the telephone or write a letter to a manufacturer every time I had a problem. Instead, I try to find the answer in the software manual or a third-party book. This works 95 percent of the time. The other 5 percent of the answers come from BBSs. And the bonus for doing it myself? More knowledge and understanding.

Personally, I like Microsoft. And if Microsoft didn't exist, who would you call? IBM? "About this problem I'm having with OS/2...hello? Hello?"

A three-page letter? Concise, he ain't.

Gary Bresau
Seattle, Washington

DEFINING "PROMS"

I would like to respond to David Duani's letter (Letters, November 26, 1991) regarding EPROM BIOSes and how they can be changed from software.

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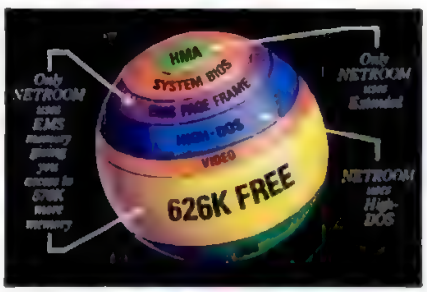

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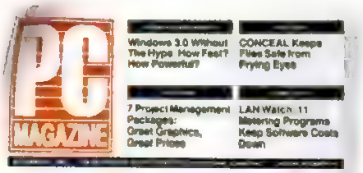

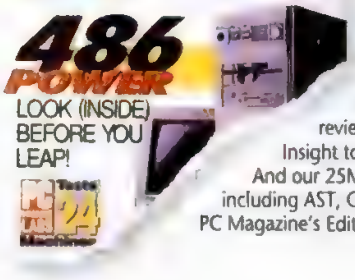

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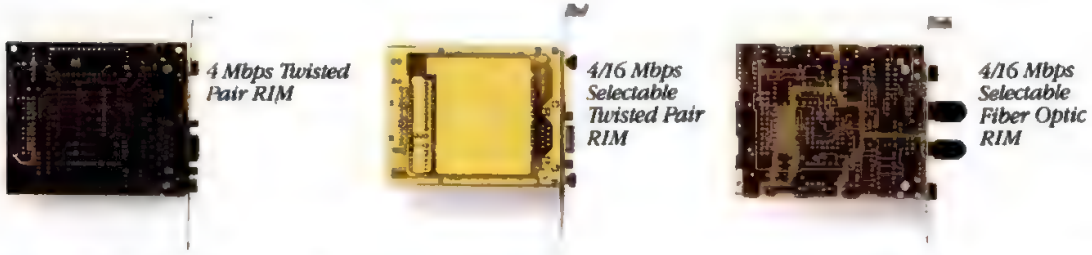

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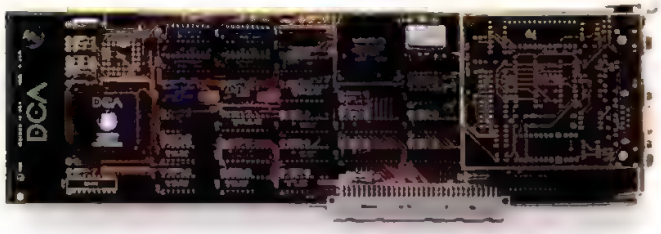

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CIRCLE 389 ON READER SERVICE CARD

Letters

must be removed first. The chip is then reprogrammed by applying the proper logic states to the address and control pins, and applying a programming voltage, usually 12.5 or 21 volts. Therefore, there is no way to modify the chip's programming from within the software.

If the chip he refers to is really an EEPROM (electrically erasable programmable ROM), there may be cause for concern. This chip behaves very much like RAM (except for speed in writing new information to the chip) and one can modify its data quite easily.

Barry Kutner
Newtown, Pennsylvania

OUT OF SORTS

I am writing to vent some steam about your Advertisers' Index/Products by Category table. Grouping advertisers by categories is an admirable idea. But unless the categories themselves are sorted, it is difficult to find anything.

For example, the categories "Accounting Software," "Anti-Virus Software," Add-On Boards," and "Apple Products" are spread over three different columns on two pages in that order, instead of appearing at the head of the list, sorted alphabetically. Please do something about this. I know it's possible, because your Editorial Product Index is arranged this way.

Fred Robinson
Southfield, Michigan

POST HOLIDAY CHEER

'Twas the night before Christmas,
When all through the house,
Not a hard drive was whining,
Not even a mouse.

The office furniture was placed
in the den with care,
In the hope that a PC
soon would be there.

The children were nestled
All snug in their beds,
While visions of computer games
danced in their heads.

And Mom in her nightgown,
With the cat in her lap,
Was thinking of software,
And the best way to wrap.

Dad was all thumbs,
On this eve in winter,
Trying to unpack the
dot matrix printer.

This was written by one
All in good fun,
Not forgetting the reason
we celebrate
the hope of the season.

Happy holidays,
The Boyle Family
Suwanee, Georgia

PC MAGAZINE This came too late to make our December issues, but it's never too late for holiday cheer.—*Ed.*

CORRECTIONS & AMPLIFICATIONS

The phone number for Access Data Recovery ("On Guard: 20 Utilities that Battle the Virus Threat," October 29, 1991) is 800-658-5199.

In the November 12, 1991, Advisor column, the references to HIMEM .SYS in the last column on page 507 should instead read EMM386.EXE.

In the November 12, 1991, New and Improved column, we should have stated that although the Polaroid CI-5000 is compatible with *ImagePrint* and *SuperPrint*, it does not come bundled with them.

In the November 26, 1991, New and Improved column, the caption for *Express Presenter* mistakenly listed the product as *Express Publisher*; the correct number for Visual Solutions is 508-392-0100. Also, Trans Digital Corp.'s file-transfer system, *Trans*, can support file sizes up to 2GB.

In the December 17, 1991, After Hours review, the phone number for Disney Software is 818-841-3326.

The phone number for Alpha Software ("Database Power Without the Programming," December 17, 1991) should have read 800-451-1018.

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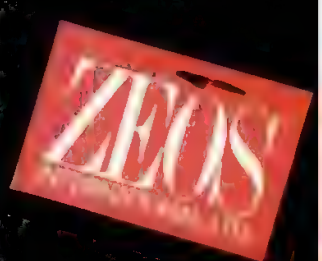

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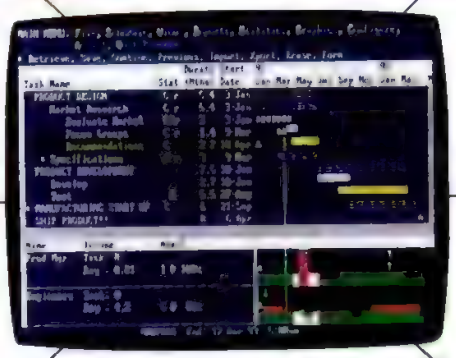

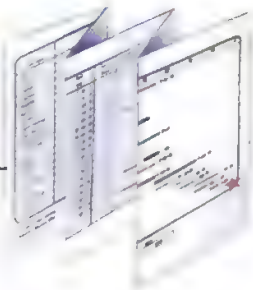

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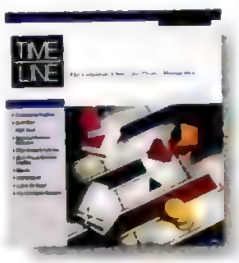

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CIRCLE 332 ON READER SERVICE CARD

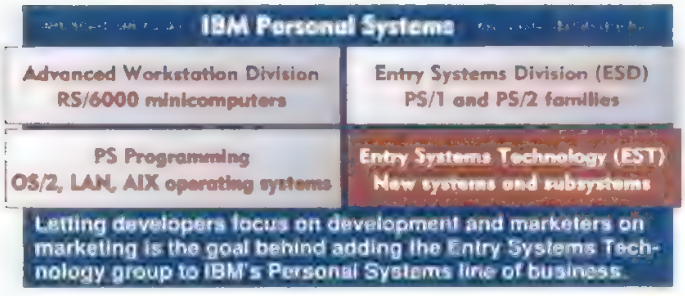
Trends

Trends & Technology Shaping the Personal Computer Market

IBM Business Units Gain Control Over Manufacturing and Pricing

Personal Systems Gets Tech Team

In IBM's end-of-the-year restructuring, its Personal Systems line of business gained some important tools that should increase its chances for survival in the fiercely competitive PC market. Most significant are more autonomy, control over manufacturing and pricing, and a new group devoted solely to product development. The changes may mean good news for IBM customers, but only if Personal Systems can meet its goal of delivering more cost-efficient products to the market more quickly than it has in the past.



Letting developers focus on development and marketers on marketing is the goal behind adding the Entry Systems Technology group to IBM's Personal Systems line of business.

Before the restructuring, Personal Systems was divided into three groups: the Advanced Workstation Division, which includes the RS/6000 line of minicomputers; PS Programming, which includes OS/2, LANs, and AIX (IBM's Unix); and the Entry Systems Division (ESD), which includes the PS/1 and PS/2 families. In December, IBM vice president and Personal Systems general manager Jim Cannavino added a fourth group called Entry Systems Technology (EST), which will focus on developing new technology. ESD will now concentrate on marketing. To some extent, the new organization formalizes an arrangement that had already existed between internal teams within ESD. But one new twist is that the technologies EST develops will be marketed to other system vendors (IBM competitors, that is), in addition to being used in IBM's personal computers.

One project underway before the restructuring that now belongs to EST is IBM's half of the joint effort with Intel to develop integrated chips based on Intel's 80x86 chip architecture. But EST has no control over Kaleida (multimedia) and Taligent (object-oriented environments), the companies IBM recently formed with Apple.

By freeing the developers from marketing concerns, Personal Systems stands a chance of shrinking its product development cycles, which are notoriously long. IBM hopes to cut the process—which typically takes two to three years—down to less than one year. But even

CONTINUES ON PAGE 32

IBM Hard Disk Line Spins Off

IBM, the largest manufacturer of PC hard disks in the world, has granted line-of-business status to its storage products division. The group had been part of the Enterprise Systems line of business, which is focused primarily on mainframes. As its own line of business, storage products gains such abstract advantages as clout and autonomy within the corporation as well as such practical benefits as worldwide manufacturing and development responsibility.

The biggest challenge facing the storage products line is that it will have to go up against competitors like Seagate and Conner Peripherals for a share of what was a captive market: IBM's own business. In the less interdependent new IBM, the group will have to become more focused on sales to customers other than IBM. Luckily, it has a head start in selling to original equipment manufacturers (OEMs): It has been selling 3.5-inch disk drives to Apple for about a year.

—Mary Kathleen Flynn

An Object By Any Other Name

Object-oriented programming has become a pet phrase of software executives. But what does it mean? And why is everybody claiming to have more of it than anyone else?

"There's confusion because there are different levels," says Philippe Kahn, CEO of Borland and self-proclaimed pioneer in object orientation. "The levels are not mutually exclusive, but they aren't mutually inclusive either. To developers, it means a component approach to software, so there's more reliability and more consistency of design. To end users, it means more predictability. If you move a spreadsheet to a printer, the spreadsheet gets printed, as you would expect." Among Borland's object-oriented products are the *Quattro Pro* spreadsheet and the *ObjectVision* 2.0 development tool.

"Object-oriented programming will be the most abused phrase in the industry over the next three to five years," predicts Jim Manzi, CEO of Lotus, whose *Improv* spreadsheet is one of the most impressive object-oriented applications to date. Currently available only for the NeXT Step environment, *Improv for Windows* will come out "when it's done," says Manzi. He defines object orientation as "just a different way of making software. Instead of seeing an application as monolithic, you look at components, objects, if you will. We've been calling it software Legos."

FAIRY DUST?

Microsoft CEO Bill Gates, who has been known to call object orientation "fairy dust," says "If you have to put true in front of a word, there's some vagueness going on. I believe in true, true, true object orientation; whereas others only believe in true object orientation. I dare anyone to figure out how many levels of true object orientation there are in any product." But while Gates is flip about the phrase, he's serious about the technology, which he defines as "using indi-

CONTINUES ON PAGE 32

Pipeline

by Gus Venditto

Free at Last: dBASE Future is Secure

Anyone who has made an investment in *dBASE* applications can't help but feel that they've been on a legal roller coast ride for several years now. Finally, the ride is over and we have the Justice Department to thank.

The problems for the *dBASE* language began when Ashton-Tate, fighting for market share, threatened to sue anyone infringing on the company's *dBASE* copyright; in essence, Ashton-Tate was trying to stop the competition from selling products that run *dBASE* commands or compile *dBASE* programs.

Ashton-Tate filed such a claim against Fox Software in November 1988. Fox fought back, claiming that Ashton-Tate's *dBASE* copyright is not valid, and even if it is, antitrust statutes protect Fox's right to compete with Ashton-Tate.

The case dragged on until last December, when a U.S. District Court judge shocked everyone by ruling that Ashton-Tate's copyright was invalid, since the company was using technology in the public domain. Ashton-Tate immediately appealed the ruling but just as suddenly, the judge reversed himself, saying the copyright was valid and that both suits should proceed.

The case would have gone to trial in mid-1992 if Borland had not made its tender offer for Ashton-Tate shares last summer.

ENTER JUSTICE DEPARTMENT

While the world tried to imagine what Borland planned for the *dBASE* language, the Justice Department got involved. It raised objections to the Ashton-Tate/Borland merger on the grounds that the new company's dominant share of the market was anti-competitive. The copyright infringement suit against Fox was an example of Ashton-Tate's anti-competitive posture.

Thanks to Borland's readiness to complete the merger and a reluctance to sue competitors, a solution was quickly worked out. The Justice Department proposed a consent decree that would resolve the dispute. Borland agreed that it would not attempt to enforce copyright protection on key parts of the *dBASE* language (including the command names, menu command hierarchies, the programming language, and the file structures). And Fox agreed to drop its countersuit.

The agreement allows Borland to defend *dBASE* trademarks, so it can protect itself against blatant piracy, but it prevents Borland from suing Fox or anyone else who attempts to build a *dBASE*-compatible language or compiler. Once Fox and Borland had agreed to these terms, the Justice Department dropped its objections to the merger. The consent decree includes several various waiting periods that won't expire until the middle of 1992, so the settlement could be derailed, but right now both sides are celebrating.

The two biggest winners are Fox and *dBASE* developers.

Fox escapes from a cloud that threatened any significant expansion. While the company doesn't see any immediate technical benefit coming from the new climate (meaning, there are no areas of the *dBASE* technology that it wants to explore), it's now free to explore a public offering or any merger possibilities that will help it grow faster and add newer technologies to its products.

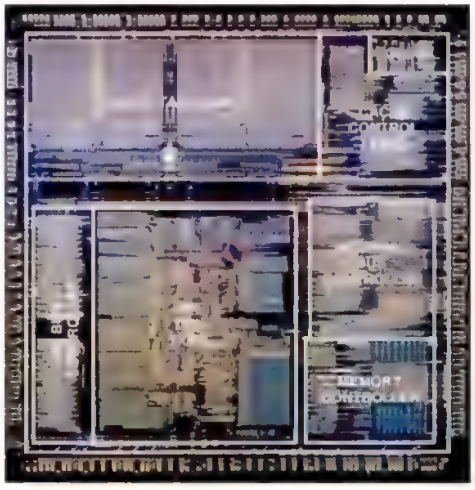
Users are going to benefit from the increased rivalry. With Borland and Fox competing vigorously, there should be more frequent upgrades and sharper competition on features. It's possible, though unlikely, that another contender for the *dBASE*-language market will emerge.

And give credit to the Justice Department. It has shown that at least some people in the government understand the dynamics of the PC market. ■

Battery Life to Double For SL-based Notebooks

More than a year ago, Intel promised notebook makers longer battery life with its 386SL chip. But until now, Zenith Data Systems, which codeveloped the power-saving features with Intel, was the only systems vendor brave enough to ship a unit based on the original A-step chip—a chip with some snags. But with its second-generation B-step chip, Intel has solved the original problems, and 45 vendors have announced products based on the chip, which should increase battery life up to twice as long as in previous notebooks.

Originally available at 20 MHz and now at 25 MHz, the 386SL was designed solely for



Intel's 386SL contains 855,000 transistors, more than three times as many as the 386SX, which has only 275,000.

New Lease on Life for dBASE

To paraphrase Samuel Clemens, the reports of *dBASE*'s death are greatly exaggerated. Just because Borland, *dBASE*'s new owner, already has a database product, that doesn't mean it's going to put *dBASE* out to pasture. After all, Borland didn't spend $439 million for Ashton-Tate just to acquire a mailing list.

Borland has lots of plans to prove there's plenty of life left in the best-selling database: A modest upgrade to the current DOS version is imminent, a Windows compiler is on the way, and a major upgrade to the DOS product as well as a full Windows version are planned for 1993.

First out will be *dBASE IV* 1.5 in February. This release is expected to be about 30 percent faster than the current *dBASE IV* 1.1 and will add mouse support.

Due out in the first quarter is *Paradox for Windows*, which will read and write *dBASE* files

Borland's Database Directions

February 1992	First quarter 1992	Mid 1992
***dBASE IV* 1.5** Modest upgrade to DOS product. Faster than *dBASE IV* 1.1. Adds mouse support.	***Paradox for Windows*** New object-oriented front end and internal database engine. Will read and write *dBASE* and *Paradox* files. Will use PAL language.	***dBASE Compiler for Windows*** Will let developers compile *dBASE* apps for Windows. Will read and write *dBASE* and *Paradox* files.

battery-powered notebooks. Containing more than three times as many transistors as the 386SX chip, the SL incorporates the 386 CPU, a cache controller, a memory controller, an AT-bus controller, and EMS 4.0 hardware. This high level of integration should help notebook makers keep prices and sizes down.

The SL is not a low-powered chip; it pulls about the same juice as the 386SX—not much when you consider the extra capabilities on the chip. It makes batteries last longer by shutting down power to memory, disks, modem, video, and serial/parallel ports when they are not in use. It can even suspend itself and resume exactly where it left off because it has a static CPU core that can be stopped at 0 MHz and still remember the contents of its registers.

New Notebooks Based on Intel's 25-MHz 386SL

	Shipping	Weight (pounds)	Battery	Battery life (hours)
Acer Slim 325SL	2nd quarter	5.5	Nickel cadmium	4
ALR VIP SL	February	7.2	Nickel cadmium	4
Dell 325 NC (color)	January	6.9	Nickel hydride	3
Epson NB-SL/25	March	7.2	Nickel cadmium	6
Everex (unnamed)	1st quarter	6.5	Nickel cadmium	N/A
Librex M386SL	2nd quarter	6.5	Nickel cadmium	3
NEC UltraLite SL/25C (color)	February	7.4	Nickel cadmium	1.5*
Toshiba T3300SL Twinhead SlimNote	January	5.9	Nickel hydride	4
386SL/25	January	?	Nickel cadmium	3
Zenith MastersPort 386SLe	December 1991	?	Nickel cadmium	8

Bugs in the original 386SL chip kept notebook makers away, but Intel's more stable second-generation chip has garnered support from 45 vendors. Available in both 20- and 25-MHz versions, these manufacturers have announced notebooks using the faster processor.

*A color active-matrix screen uses more power.

POWER POLICE

To applications, the SL chip looks identical to the 386SX. It crunches instructions at 32 bits internally and talks to the bus at 16 bits. To the system, the 386SL looks like a traffic cop.

In System Management mode, the 386SL uses the new System Management Interrupt (SMI)—which has the highest level of priority over other interrupts—to send messages to the chip. The SMI commands the 386SL to reduce power to the disk or modem, and wakes them up again when needed. An SMI can even detect when the battery gets low and suspend the system, saving everything in memory. A new RESUME instruction in the chip restores it to its original state without losing data. Advanced Micro Devices' 25-MHz AM386SXL—used in the AST Premium Exec 386SX/25 notebook—has a similar System Management Mode, but it doesn't have the high degree of integration that the SL chip has.

The SL doesn't regulate power all by itself; it requires SL-aware system software. Award, AMI, Phoenix, and Quadtel have developed power-saving BIOS software for the SL. Phoenix has gone one step further and developed an entire suite of utilities that notebook makers can use for power management without having to develop their own.

Microsoft is doing its part too. Windows 3.1 will save energy if you have a 386 system with a matching BIOS. Microsoft/Intel's Advanced Power Management (APM) specification in Windows 3.1 will tell the 386 when the system is not in use—between keystrokes—and will transparently reduce power to the chip. An APM driver for DOS 5.0 that will provide power savings is due shortly.

While the second-generation SL-based notebooks will surely run longer than comparable SX products, further gains in battery life will occur when applications are power-aware, too. In the future, your applications will say, "I'm not busy; power me down, Scotty."—*Christopher Barr*

as well as *Paradox*'s. Shortly thereafter, *dBASE IV Compiler for Windows* is due. It will let developers port DOS applications to Windows and create new *dBASE* applications for Windows. And because it uses the same internal database engine as *Paradox for Windows*, it will read and write *Paradox* files as well as *dBASE* files.

Sometime within the next year, Borland will release *dBASE for Windows*, which will use the same front end as *Paradox for Windows*. Both Windows products will be able to read and write each other's files. The major difference between the two products is that *Paradox* will use the *Paradox* Application Language (PAL), while *dBASE for Windows* will use the *dBASE* language. Database developers will choose the language they want to work in and compile applications appropriately.

With the two products becoming more alike under Windows, does that mean Borland's secret strategy is to migrate users to *Paradox*? Absolutely not, Borland assures us. And the company says it'll prove it with *dBASE "V,"* an as-yet unnamed major upgrade to *dBASE IV*, which the company plans to release within the next year.
—*Christopher Barr*

Future	Future
dBASE for Windows Will use the same front end and database engine as *Paradox for Windows*. Will read and write *dBASE* and *Paradox* files.	***dBASE "V"*** Unnamed major upgrade to DOS-based *dBASE IV*.

TOP 15

1. **QEMM-386 6.0** Quarterdeck Office Systems
2. **Microsoft DOS 5.0 Upgrade kit** Microsoft Corp.
3. **WordPerfect 5.1** WordPerfect Corp.
4. **Microsoft Windows 3.0** Microsoft Corp.
5. **Quicken 5.0** Intuit
6. **DR DOS 6.0** Digital Research Inc.
7. **ProComm Plus 2.0** Datastorm Technologies
8. **The Norton Utilities 6.01** Symantec Corp.
9. **PC Tools 7.1** Central Point Software
10. **WordPerfect for Windows Trade-Up** WordPerfect Corp.
11. **Lotus 1-2-3 2.3** Lotus Development Corp.
12. **Stacker 2.0** Stac Electronics
13. **Microsoft Office** Microsoft Corp.
14. **WordPerfect 5.1 for Windows** WordPerfect Corp.
15. **Microsoft Works for Windows** Microsoft Corp.

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending December 7, 1991. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and can not be interpreted as a complete picture of the entire software market.

Sales information compiled by Ingram-Micro.

BRIEFS

■ **Welcome to the second decade:** Hardware giants like Compaq and IBM aren't the only ones rethinking their strategies. "The business model that worked in our first ten years may not apply in our next ten years," said Lotus CEO Jim Manzi when the software house laid off 10 percent of its workforce (roughly 400 people) late last year. Sounds like Manzi read the same management guides as new Compaq CEO Eckhard Pfeiffer, who said a month earlier, "The success formula for the nineties will be very different from the success formula of the eighties."

■ **"What you can buy today for $3,000 is a lot better than what you could buy three years ago,"** says Microsoft vice president Brad Silverberg. "Instead of spending less to buy the same machine, people are looking to buy the best system they can find for the same money. We call it the hardware sweet spot, and it's somewhere between $2,500 and $3,500." Three years ago, that price range bought you a 16-MHz 286 with 1MB RAM, a 20MB hard disk, and an EGA monitor from mail-order houses Dell, Gateway 2000, Northgate, and Zeos. Today, it will get you a 33-MHz 486 with 4 to 8MB RAM, a 100 to 200MB hard disk, and a Super VGA monitor, plus some serious applications.

■ **Making PostScript a communications protocol for remote printing** is what NEC Technologies and Adobe have in mind. They've developed a receive-only fax modem that understands PostScript Level II for NEC's new $2,249, 6-page-per-minute Silentwriter Model 95 PostScript printer.

■ **Windows and Windows apps account for 20 percent of Ingram-Micro sales.** "That's up from zero before Windows 3.0 was released," says Robert Grambo, software buyer for the distributor. But DOS applications still outsell Windows apps four to one.

RX for Speed: Video On the System Board

Programmable coprocessors and graphics accelerators are already doing their parts to boost video performance in the graphics-intensive Windows environment, but further increases are about to be realized by putting video on the local bus, which cuts through the infamous I/O bottleneck.

Last November, the Video Electronic Standards Association (VESA) formed a committee to develop a standard spec for implementing local-bus video on system boards, but the committee doesn't expect to make even a recommendation until midyear. In the meantime, video and system board vendors are moving ahead to deliver products that take advantage of the speed of the local bus.

Untethering video from the 8-MHz I/O bus and giving it access to the 25-, 33- or even 50-MHz local bus should mean performance improvements of at least 30 to 100 percent. NEC was the first vendor to market a product to end users; the NEC PowerMate SX/20i gives the on-board Tseng Laboratories video controller access to the local bus. On PC Magazine Labs Windows tests, however, the product showed only a 6 to 7 percent increase over a traditional Tseng-based card, indicating that NEC had failed to optimize for local-bus operation. The VGA hardware tests showed improvements of up to 60 percent. (See First Looks, November 12, 1991.)

LOCAL-BUS CHIP SETS

NEC may have been first, but soon end users will have lots of choices. System-board maker OPTi has developed a local-bus core logic chip set that allows component chips—primarily video for now—to run at CPU speed. Vendors can combine the OPTi part with their own video controllers on system boards or add-on cards. Video chip set makers Headland Technologies, S3, Tseng Laboratories, and Trident Microsystems are all using OPTi's part. Video boards and PCs that use the part should start to show up in early 1992.

Instead of relying on a third party such as OPTi, Western Digital is working on a chip set that combines video with its own core logic. And Appian Technologies is going one step further, combining video, core logic, and SCSI and IDE interfaces on its Appian Express Modular Local Bus Architecture product—essentially a system board that lacks only a processor and memory.

At Fall Comdex last October, Intel and Dell demonstrated a forthcoming product that lets the CPU manage pixels locally using system memory. Though performance increases promise to be dramatic, the partners say it is still under development.

VDi is taking an approach similar to local-bus video. Its high-end coprocessed board does bus mastering and is able to access system memory. Although this approach will bring performance increases, it won't allow video to run at CPU speed.

—Oliver Rist

Personal Systems

CONTINUED FROM PAGE 29

that may be too long; Dell, for example, has managed to get its development cycle down to four months on some products. And the lead time may not be the only bottleneck at IBM. The PS/2 L40SX laptop was reportedly developed in less than a year, but it still trailed competing products from Compaq, Dell, Sharp, and Texas Instruments.

PRICES MAY LOWER

Other changes that bode well for Personal Systems and Cannavino are new control over manufacturing and pricing. Previously, manufacturing was up to IBM's five geographic units: the U.S., Canada, Asia Pacific, Europe and Africa, and Latin America, and only IBM U.S. reported to Cannavino.

Now all the factories are under his rule. And he gained flexibility in choosing suppliers; Personal Systems can use whatever components make the most sense instead of being a captive market for other IBM divisions. Finally, Cannavino and his new management board, which includes an executive from each of the five geographic units, got control over worldwide pricing, which was previously set by the corporation. That shift may mean lower prices for users.

To secure its survival, IBM's Personal Systems still has far to go: getting products to market more quickly, lowering prices, and strengthening its technology leadership are essential. But the new technology group and new controls are certainly steps in the right direction.

—Mary Kathleen Flynn

An Object by Any Other Name

CONTINUED FROM PAGE 29

rect dispatching so that you can perform an operation without having to understand the underlying form of the data. All our new products—the new user interface, document architecture, OLE (object linking and embedding)—use levels of object orientation."

Many credit Stephen Jobs, CEO of NeXT, with developing the most object-oriented environment to date. Philippe Kahn says NeXT Step is "no more object oriented than anything else," but Jim Manzi calls it "the richest and best development environment today," and even Bill Gates says it "does some very nice things, and did them before others." Jobs agrees that it "is in danger of becoming meaningless, like artificial intelligence." To be object oriented, says Jobs, a product "has to have an object structure. It has to use runtime binding; it has to have messaging; and there has to be a rich suite of objects."

But perhaps it takes a hardware executive to put the software technology into perspective for end users. Michael Dell, CEO of Dell, sees object orientation as "just another evolution in the user interface, like multimedia. It's all part of getting communication with PCs to be more like the way we communicate with each other."

—Mary Kathleen Flynn

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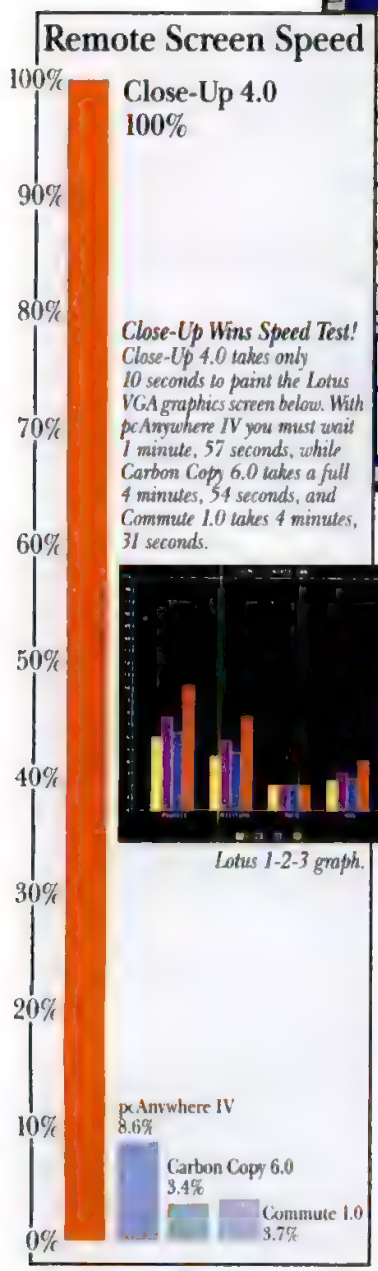
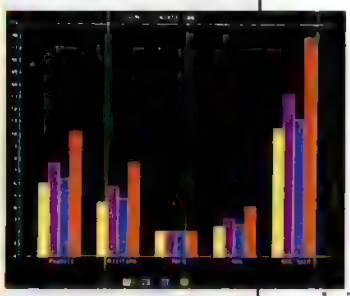
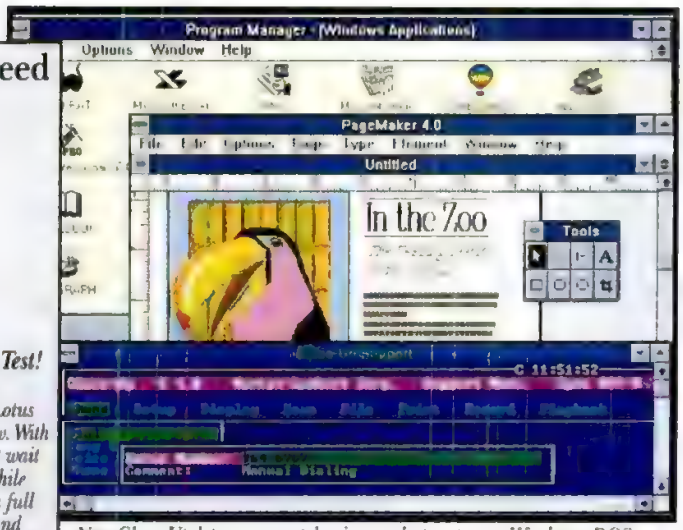


Close-Up Wins Speed Test! *Close-Up 4.0 takes only 10 seconds to paint the Lotus VGA graphics screen below. With pcAnywhere IV you must wait 1 minute, 57 seconds, while Carbon Copy 6.0 takes a full 4 minutes, 54 seconds, and Commute 1.0 takes 4 minutes, 31 seconds.*



Lotus 1-2-3 graph.

In the time it takes Close-Up to paint 100% of the above Lotus VGA graph, pcAnywhere IV has painted just 8.6%, Carbon Copy 6.0 has painted just 3.4% and Commute 1.0 has painted just 3.7% of the graph.



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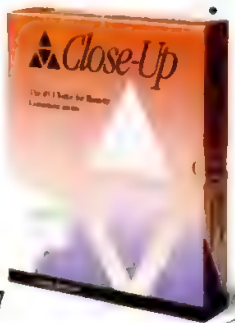

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†We invite you to reproduce our Remote Screen test. The graph used was a color VGA graph found in Lotus 1-2-3 Release 2.2, on the "Sample Files Disk." The file is TUTOR9X.WK1. The PCs were Everex 16 MHz 386/SXs and the modems Hayes 2400 baud Smartmodems. The baud rate was 2400.

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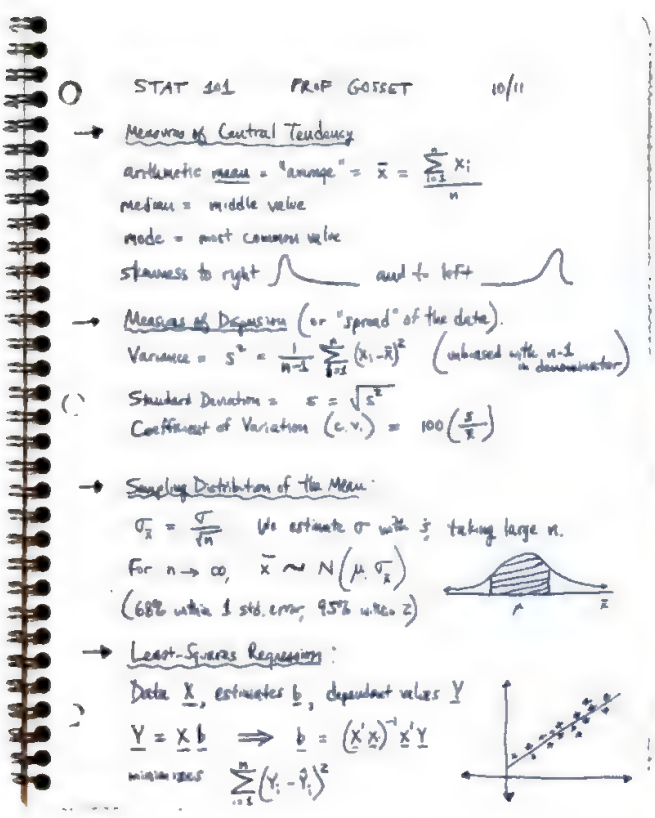

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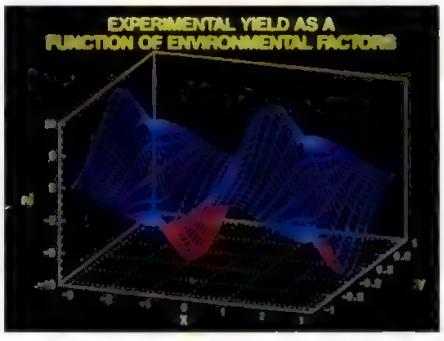

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PC MAGAZINE EDITORS' CHOICE

CIRCLE 365 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

Aldus FreeHand: A Mac Illustration Legend Comes to Windows

HANDS ON
By Lisa Gurnick

Aldus FreeHand is, simply stated, a legendary Mac illustration program. The recent port of this $595 program to the Windows operating environment gives PC users an opportunity to examine the legend first hand.

Anyone who is familiar with illustration programs will be struck by the fact that *Aldus FreeHand for Windows* does not offer radically different functions—or even a more extensive toolset—than PC-based competitors *CorelDRAW*, *Micrografx Designer*, and *Arts and Letters Graphics Editor*.

Like those other programs, *Aldus FreeHand* allows you to draw straight lines, Bezier curves, free-form shapes, and geometric primitives such as circles and rectangles. You can also enter text, assign typestyles, and align your words along an irregular path. In addition, you can resize, skew, rotate, align, mirror, and lock objects.

What distinguishes *FreeHand* from its competitors is the implementation of its feature set. First and foremost is the program interface, which—not surprisingly—bears a strong resemblance to Aldus's flagship product, *PageMaker*. This is especially useful for corporate users, who will feel immediately comfortable with the *PageMaker*-like guidelines and floating palettes.

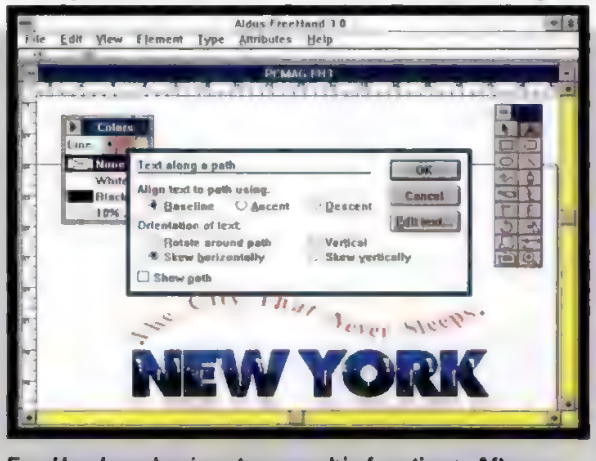
Palettes include an 18-item toolbox, a palette for named colors, a layer manager that can handle up to 99 overlays per drawing, and a style palette. Unlike *PageMaker*, a *FreeHand* style does not contain typestyle information. Instead it consists of line weights, color specifications, and fill patterns. All of the palettes are intended to help artists manage complex drawings. For example, if you edit the fill pattern of a named style, the change will be applied to all objects that share that style—making it easy to effect global changes in a complicated illustration.

FreeHand is also distinguished by its typographic functions. The program ships with *Adobe Type Manager* 1.5, which gives you only 13 basic fonts up front. But if you are willing to invest in PostScript Type 1 and Type 3 fonts, you'll find that *FreeHand* (more than any other program on the market) takes advantage of their capabilities. So, in addition to point size, intercharacter or interword spacing, and leading, you can also specify character width via the Horizontal Scaling option. Moreover, many of the special text effects that *FreeHand* offers, including Zoom (a blended 3-D look), automatic drop shadows, and In-line (a neon-like trim), are only guaranteed to work with PostScript fonts.

FreeHand's mastery of type is most evident when you align text along an irregular path. The function is actually very easy to use. You simply join text to a path and then choose between options in the Element Info dialog box—such as Skew Horizontally or Rotate Around Path—to fine-tune the effect. You can also interactively edit the shape of the path or use a dialog box to alter the content and format of the text. *FreeHand*'s sophistication lies in the fact that it uses the new parameters to correctly recalculate the position of the text each time you make a change. Quite frankly, it does a much better job with this sort of modification than *CorelDRAW*.

FreeHand's single-minded focus on editing functions and on-the-fly recalculations represent both a strength and a weak-

CONTINUES ON PAGE 42



***FreeHand* emphasizes typographic functions. After you have joined a text element to a path you can edit the effect by changing the alignment options in the Element Info dialog box and edit the path interactively.**

FEBRUARY 11 REVIEW INDEX

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Advanced image editing at affordable prices.....40

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FACT FILE

***Aldus FreeHand for Windows*, Version 3.0**
Aldus Corp., 411 First Ave. South, Seattle, WA 98104, 800-685-3540
List Price: $595
Requires: 286 or better processor, hard disk, 2MB RAM (4MB recommended), Microsoft Windows 3.0 or later, EGA or better graphics adapter, mouse.
In Short: A port of the well-loved Mac program, *FreeHand for Windows* has a user interface that *PageMaker* users will appreciate, along with fine capabilities for handling type. It lacks many of the special effects features found in other PC illustration packages.

CIRCLE 433 ON READER SERVICE CARD

Project Managers: A New Focus on Graphics And Resource Controls

HANDS ON
by Henry Ferstle-Weiss

The competition in the low-cost project management arena has moved ahead on two main fronts: better graphics and finer resource management. To this end, three new products have carved their individual niches. Computer Associates transforms *CA-SuperProject for Windows*, one of the top character-based project managers, into a Windows-based graphics product. Symantec's *Time Line*, the program with perhaps the largest installed base, is now capable of modeling how resources are used in the real world. And Scitor's *Project Scheduler* has tackled multiple project management.

Now that *Time Line* 5.0 has roughly the equivalent resource management capabilities as *CA-SuperProject for Windows*, these two programs stand a cut above the others in the field. To compete, other products will have to match or surpass the graphics and resource management features. But not all of the contenders have had their final word. A new version of *Microsoft Project*, scheduled for release shortly, is expected to address the same issues.

SUPERPROJECT: GRAPHICS ARE GERMANE

For project managers, graphics provide more than a flashy appearance: they make schedules, resource allocations, and work breakdowns more understandable. The advantage of good graphics was first exploited in *Project Scheduler 4*, which had its own graphical interface. The program was further improved last year (see sidebar), but not before Microsoft Corp. showed what interactive graphics under Windows could mean for ease of use in its *Project for Windows* program. The next Windows-based project manager was *On Target* from Symantec—the makers of *Time Line*—and now there's *SuperProject for Windows*.

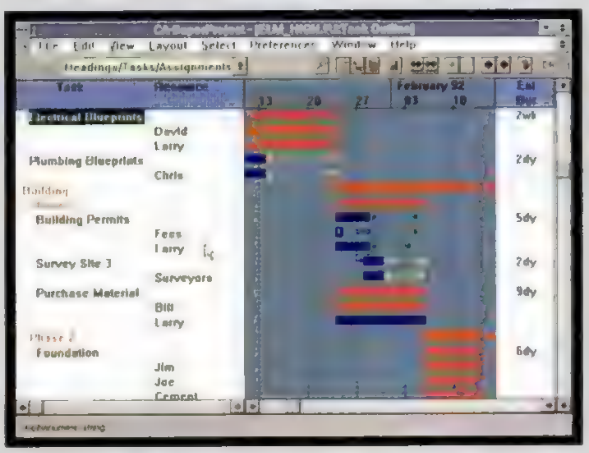
The graphics in *SuperProject* take advantage of many of the standard Windows facilities. You can change the colors, styles and symbols for task and resource bars on Gantt charts; change the colors for headings, text, and background on screen displays; drag task bars around on the screen with a mouse or stretch their end dates; paint task dependencies directly using an icon on the toolbar; access the full array of Windows device drivers and fonts for printouts; and do WYSIWYG reporting.

While *SuperProject* has long offered several project views, the Windows version also lets you mix views and control layouts. In the task view you can load one of 13 preset layouts, including one that shows a Gantt chart with a histogram of total cost, budgeted cost of work scheduled and budgeted cost of work performed (BCWS and BCWP).

Although the layouts greatly extend *SuperProject*'s ability to present project information—and offer control over screen graphics that go beyond the abilities of *Time Line* 5.0—the layouts are not as flexible as the ones in *Microsoft Project for Windows*, which lets you put together virtually any chart and detail screen.

In addition to giving you more flexibility in viewing individual projects, *SuperProject* now lets you view more than one project at a time. By viewing the Gantt charts for two linked projects, you can see where schedules and resource allocations overlap, which makes working with multiple projects that much easier.

One of the main advantages of *SuperProject*'s graphics is increased ease of use. In the past, it was hard to access the product's rich functionality. Now, all its features are easily accessible, like a well-stocked workroom



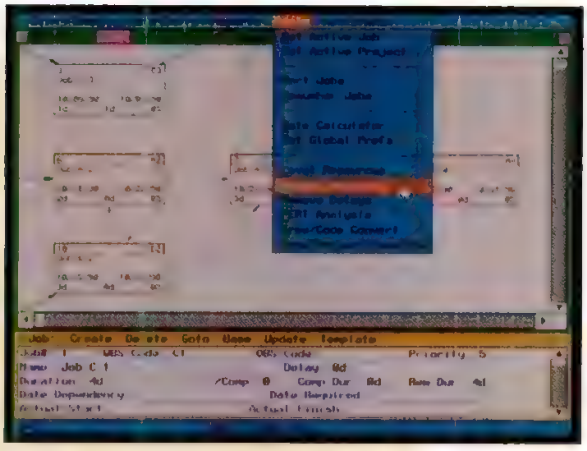
CA-SuperProject for Windows **faithfully transfers all the powerful features of the DOS version of this product into the world of Windows. Here, the graphical advantages are obvious: You have control over the Gantt bar symbols, style, and color. You can also add color to the background, the title bar, and to text headings. Gantt bars are interactive so you can drag them to change start dates or lengthen the duration.**

PROJECT SCHEDULER DOES MULTIPLE PROJECTS

Not quite new to market but worthy of mention is *Project Scheduler 5* from Scitor Corp. It has followed its own route. When *Project Scheduler 4* was introduced, it was the best graphical implementation of a project management program. But it had a proprietary interface, which it maintained when *Project Scheduler 5* was introduced in November 1990 (just a couple months after the last project management article in *PC Magazine*, September 11, 1990). The new version adopted some of the interactive graphics abilities of *Microsoft Project*, but it also made some big strides in resource leveling and multiple project processing.

Project Scheduler 5 stands out in the management of multiple projects. You can link projects together in a way that establishes cross-project dependencies by task but maintains the independence of the projects involved. This means that a manager can work with his or her project and try to resolve schedule and resource problems independently before a cross-project schedule is updated. Individual managers are flagged that agreements they've made to other managers have slipped, but only when the linked projects are all brought into memory is the cross-project schedule updated. Projects can be dependent on each other even if they don't share resources.

The graphical interface in *Project Scheduler 5* employs pull-down menus, dialog boxes, and scrollbars, just as in Windows. As with *Microsoft Project* and now *SuperProject for Windows*, the program is extremely easy to learn and use. *Project Scheduler 5* makes graphics smarter. Now you can drag a task bar in the Gantt chart to a new position to change its start date or push and pull its end-date edge to adjust the duration. You can also change the percent complete on a task by dragging that portion of a task bar. Still, while the pro-



Project Scheduler 5 provides clarity for work with multiple projects. You link projects together at the task level simply by drawing dependencies between the task boxes on a network diagram. Multiple projects can be split apart and worked separately and then rejoined with the links intact. A template window at the bottom of the screen lets you see details on tasks, resources, or dependencies.

gram's graphics are clean and bold, you don't have nearly the same control that you do in *Microsoft Project* and *SuperProject for Windows*. You can change the task bar end symbols, but you can't change bar colors, adjust colors used elsewhere on the screen, or change the text styles.

In the area of resource management, *Project Scheduler 5* has made one important improvement. Resource leveling now takes into account both project and task priorities on a scale of 1 to 9. In other areas of resource management, *Project Scheduler 5* comes close to *SuperProject* and *Time Line*. It offers resource calendars and varying availability, but resource costs can be varied by only five dates.

Project Scheduler 5 shuns some of the richer graphics capabilities of the Windows-based programs in favor of ease of use and consistency among users, and it is somewhat weaker in its use of resources. But the program's balance in ease of use, graphics, resource management, and multiple project controls is quite appealing. ■

with tools neatly hung on the wall in front of you. However, *SuperProject* still lacks some of the ease-of-use features in *Microsoft Project*, such as a date display that pops up as you drag a Gantt bar into the future.

TIME LINE'S FOCUS ON MODELING

While *Time Line* stubbornly clings to its character-based heritage, it has not stood still when it comes to resource management, which was one of the significant weaknesses of earlier versions. In *Time Line* 5.0, you can now vary the availability of resources by amount, percentage, and date.

You can indicate that a group of engineers would consist of six people working at 100 percent when a task begins, drop to four people working at 50 percent on a date that is one month into the task, and change in this manner over 300 times per resource. Varying availability also lets you introduce efficiency factors into your scheduling by saying that an individual can only work at 75 percent capacity when a project begins, but then work at 100 percent capacity after he or she comes up to speed on the task. Resource cost rates can vary in a similar way.

New individual resource calendars give *Time Line* even more control over resources. Now each person or piece of equipment can have vacation days or periods of inactivity.

Another new feature in *Time Line* is the ability to split tasks. You can schedule a task to begin before a vacation or other type of downtime and then continue when resources are available again. Resources can also get a head start on tasks by beginning as soon as they become available. And if the effort on a task is out of sync with the duration, the actual-versus-planned time spent on a project can be split apart and tracked separately. Both of these conditions affect the scheduled end-date of a task and make the schedule more accurate.

However, these methods of profiling a resource are also available in *SuperProject;* they were available even before the Windows version. In fact, in *SuperProject* you can profile resource use at an even finer level: On the resource calendar you can specify the hours a resource is available on any day and have this override the workday on the project calendar.

Because *Time Line* is character-based it doesn't have nearly the same capabilities as *SuperProject* in on-screen graphics or layouts. But it competes better on the output end, since you have control over the types of bars in charts, border thickness, corner style, shadows, and color. You can place titles, legend symbols, and legend text wherever you want; control the size of your charts by the number of pages or the percentage of the page; and preview your work on the screen in true WYSIWYG splendor. The main drawback of *Time Line*'s print graphics is the inability to change font styles—you get only one.

Both *SuperProject* and *Time Line* have increased task capacity over their previous versions. Because of the memory utilization scheme in Windows, *SuperProject* can now handle up to 16,000 tasks rather than the 600 to 700 task limit of its previous version. *Time Line* now has an official limit of 2,500 tasks instead of 2,000 (because it takes less RAM to run), but projects with few resources and less detailing might be able to have 4,000 or so tasks. ■

List Price: *CA-SuperProject for Windows*, $895; $195 for upgrade. **Requires:** 2MB RAM, hard disk, DOS 3.0 or later, Windows 3.0 or later. Computer Associates, One Computer Associates Plaza, Islandia, NY 11788; 800-225-5224, 516-342-5224.

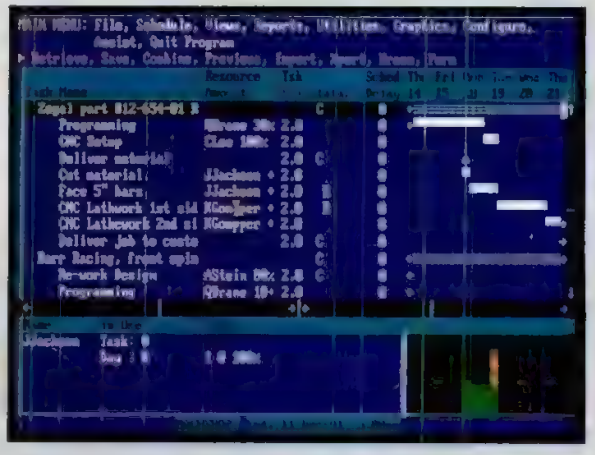
CIRCLE 428 ON READER SERVICE CARD

List Price: *Time Line*, Version 5.0, $699; $179 for upgrade. **Requires:** 640K RAM, hard disk, DOS 3.0 or later. Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014-2132; 800-441-7234, 408-252-3570.

CIRCLE 429 ON READER SERVICE CARD

List Price: *Project Scheduler 5*, $685; $250 for upgrade. **Requires:** 512K RAM, hard disk, DOS 3.0 or later. Scitor Corp., 393 Vintage Park Dr. #140, Foster City, CA 94404; 415-570-7700.

CIRCLE 430 ON READER SERVICE CARD



Time Line 5.0 has added a great deal of flexibility to the way resources get assigned to a project. Now you can vary a resource's availability as often as you like.

Image Editors that Break the $200 Barrier

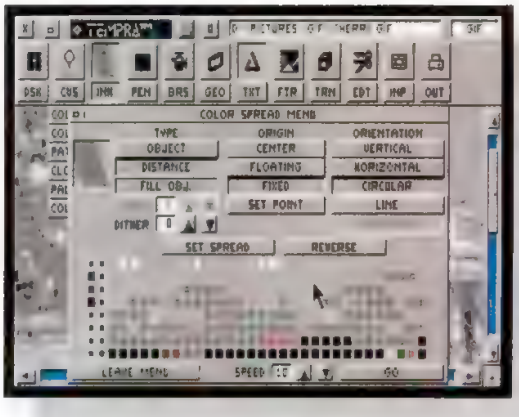
HANDS ON
by Barry Simon

High-end image-editing programs go far beyond their paint-program ancestors by including sophisticated tools that can manipulate expanses of bitmaps rather than individual bitmaps. Typically, the feature set includes filters, palette remapping, and full-image transformations. These packages usually cost $495 and up.

Thanks to the proliferation of inexpensive hand scanners and word processors that can easily embed bitmaps, these image-editing and retouching tasks extend beyond the realm of professional artists and desktop publishers. Two new products, one for Windows and one for DOS, provide image-editing features at a price that occasional users can justify.

ZSoft's $199 *PhotoFinish* is a Microsoft Windows application that supports a vast array of image manipulation tools. It supports 24-bit color and a variety of scanners. Mathematica's $149 *Tempra GIF* is a DOS-based application with a proprietary GUI interface that runs on VGA and Super VGA. *Tempra GIF* also has plenty of image-editing tools but lacks scanner support. It's limited to 8-bit color, but that includes support for the 256 gray scales that many users with black-and-white printers use most frequently.

Both programs have bigger, more feature-laden counterparts. ZSoft released its Windows-based, $495 *Publisher's Paintbrush* 2.0 last spring. This spring, ZSoft expects to release a revised high-end product. Mathematica has two high-end products that share the *Tempra GIF* interface—the $495 *Tempra Pro* and the $790 *Tempra Pro Turbo*. *Tempra GIF* is a strict subset of these products. The trio of menus are identical, but the choice of certain items in the *GIF* version brings up a gauche message telling you that you need the *Pro* version to access those items. *Tempra Pro* adds three features: support for 24-bit color images, for several color printers, and for Howtek and Sharp color scanners. The $295 turbocharger add-on uses Intel's C Code Builder to make a true 386 version that runs faster than *Tempra Pro* and *Tempra GIF*.



Tempra's color spreads go beyond conventional gradients; it can cycle between two user-specified colors. A fill can start at red and end in blue, with brown and green in between.

TEMPRA GIF: IMAGING FOR DOS

Both the interface and paradigm used by *Tempra GIF* require acclimation, since they don't conform to many industry conventions. The top-level menu choices have associated push buttons; more than one of these buttons can be depressed. Therefore, the same rectangle choice from the geometry menu will act differently depending on which other buttons are pushed. If the filter button is depressed, the area inside the rectangle will sharpen or soften the image depending on the subchoice you made last in the filter menu. If the Edit Menu button is depressed, the rectangle may instead set a mask area. This is different from a paint toolbox, where you are presented with several relevant buttons while the others are hidden from view.

Tempra's color spread is a generalized gradient. From a graphical display of a palette with 256 colors, you choose start and end colors. The fills in-between colors are not necessarily the ones interpolating between the start and end colors but are those displayed on the color palette. So you could have a spread that starts at red and ends at blue, with brown and green in between. If you want a conventional gradient, you can issue a command to interpolate the intervening palette slots with the intervening colors. The result is more powerful options but more effort.

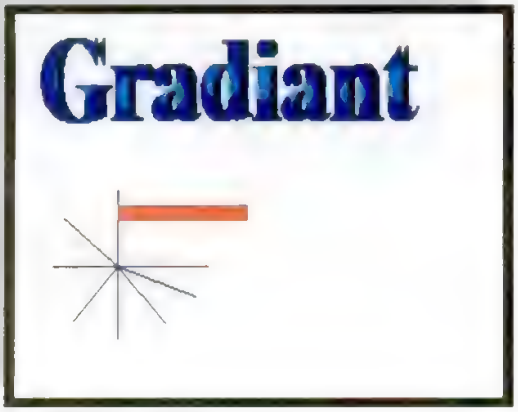
Tempra GIF's outstanding bitmap drawing tools include the usual box, ellipse, and Bezier curves and also arcs, parallelograms, and polygons. A special repeat option lets you quickly and easily create a number of successive objects with a color spread. When placing multiple lines, you can choose to have the start point of latter lines be the last end point or the first start point, so you can quickly draw stars, as illustrated on the left.

Many aspects of *Tempra GIF* are a result of its non-Windows interface. Draw and redraw times are faster than those of Windows image editors, but speeds for applying filters and other behind-the-scenes processing are lackluster. Since there's neither a clipboard nor a multiple-document interface, the only way to transfer images from one drawing to another is to clip an image to disk. In sum, the interface is different from other paint and image processors, and in my opinion, it's awkward.

All of the *Tempra* programs support close to 300 black-and-white printers in what the program properly calls draft mode, but only *Tempra Pro* supports color printers. There's no online help, and the *Tempra GIF* manual is sparse.

Tempra GIF stumbled in our workout. The program won't load if your environment exceeds 168 bytes, as it may with a long path statement. When you try to clear a picture, the program properly warns you of unsaved changes, but if you load a new picture, it will happily overwrite your work without warning. And the program's Undo function does not work properly with the Transform function.

Tempra GIF is an interesting choice for DOS users, and *Tempra Pro* with the turbocharger feature is an option for professionals who work with large images where speed is critical.



Among *Tempra*'s unique drawing tools is the possibility of drawing many lines with the same starting point.

PHOTOFINISH: HIGH-END FEATURES IN A LOW-COST PACKAGE

The only thing low-end about ZSoft's *PhotoFinish* is its $199 price tag; the feature set is impressive. It supports response curve editing, numerous filters, many scanners, and 24-bit color. You can create or process black-and-white, 256-color, and 256-gray-

CONTINUES ON PAGE 42

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CIRCLE 259 ON READER SERVICE CARD

Image Editors

CONTINUED FROM PAGE 40

scale images as well as 24-bit images. The interface is very close to ZSoft's *Publisher's Paintbrush*. The main differences are 3-D effects in dialog boxes and use of the new Windows 3.1 common file dialog, which separates the choice of drive and directory. There's a floating toolbox with 37 buttons (plus an optional 24-button mode where several tools are grouped together), a floating palette, and a floating brush-configuration tool.

PhotoFinish shares *Publisher's Paintbrush*'s method for handling multiple image displays—a method unmatched by other image editors. The ability to load multiple copies of a single image lets you view the original image from disk and edit a copy at the same time. You can also make a duplicate of an image window, link the windows, and keep a normal-size image in one window and a blown-up image in the other. When you click on the normal-size image, the magnified image in the other window moves to the spot where you clicked.

Three features in *PhotoFinish* that aren't currently in *Publisher's Paintbrush* are a magic wand, soft brushes, and support for Windows fonts instead of a proprietary font scheme. The magic wand tries to select a single irregularly shaped object in a picture by using color changes to detect its boundary. The object can then be selected for filter application or flood fill. The soft brush lets you paint with an adjustable level of transparency. The soft airbrush and clone features also let you adjust transparency. Other notable additions are poster printing and image stitching, which is especially useful when using a hand scanner.

Features you might miss in the low-end *PhotoFinish* that are in *Publisher's Paint-brush* include make-your-own-filter, workspaces, calibration, and detailed control over halftoning algorithms. Some of the same effects can be achieved in *PhotoFinish*, but they take more work. For example, *Publisher's Paintbrush* lets you draw a tile-filled rectangle; *PhotoFinish* requires you to draw a hollow rectangle and then use a tile flood fill.

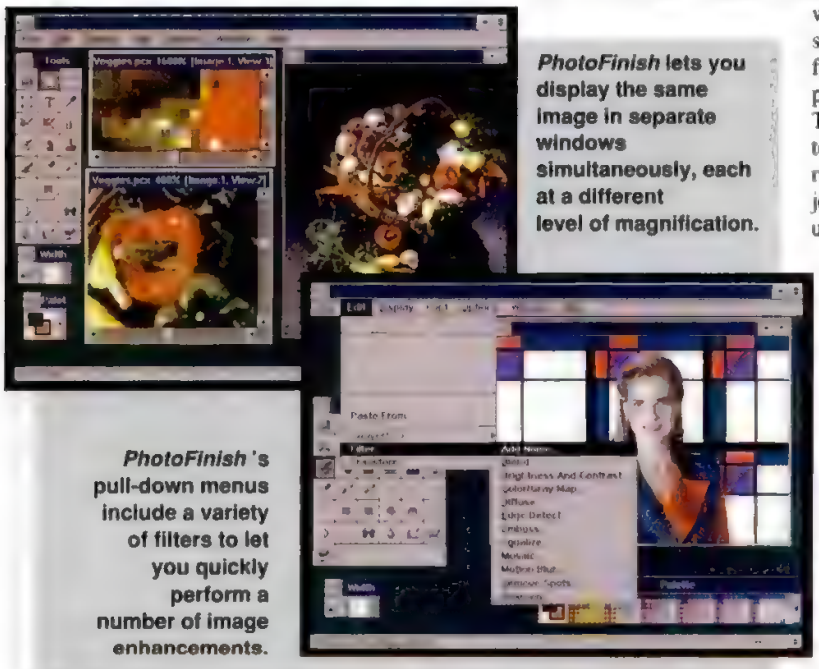
With its affordable price and impressive features, *PhotoFinish* defines the market for low-cost, robust bitmap editors. It's a superb product at any price and a bargain to boot. ■

List Price: *PhotoFinish*, Version 1.0, $199. **Requires:** Microsoft Windows 3.0, mouse, color display adapter. ZSoft, 450 Franklin Rd., #100, Marietta, GA 30067; 404-428-0008.

CIRCLE 416 ON READER SERVICE CARD

List Price: *Tempra GIF*, Version 1.04. $149 for GIF; *Tempra Pro*, $495; turbo charger add-on, $295. **Requires:** 640K RAM, VGA or Super VGA display card. Mouse recommended. Mathematica Inc., 402 S. Kentucky Ave., Lakeland, FL 33801; 800-852-6284, 813-682-1128.

CIRCLE 417 ON READER SERVICE CARD



***PhotoFinish* lets you display the same image in separate windows simultaneously, each at a different level of magnification.**

***PhotoFinish*'s pull-down menus include a variety of filters to let you quickly perform a number of image enhancements.**

Aldus Freehand for Windows

CONTINUED FROM PAGE 37

ness. It's great to subselect and edit individual elements that are part of a larger group of combined objects. For example, if you change the starting shape of a multi-object blend, *FreeHand* will automatically recalculate the shape-interpolation using the new object.

On the downside, all of these recalculations can really put a strain on system resources. With the recommended configuration of a 386 processor and 4MB of RAM, path editing was slow. And complex images took a long time to redraw in both Preview and Outline working modes. More memory can help this performance problem, and also allow you to get the most out of other memory-intensive features such as the user-defined number of Undo levels and the ability to open multiple documents.

Users who want lots of bells and whistles will be disappointed with *FreeHand*'s modest collection of special effects. You can create blends that transform the shape and color of one object into another object. You can use the outline of one object to clip another object, as in the illustration on page 37 where the text outline clips the picture of the New York City skyline. And you can effortlessly apply patterns to the objects in your drawings. *FreeHand* has 64 editable bitmapped motifs, 19 PostScript patterns, and the ability to copy any object to the Clipboard and paste it back into your drawing as a fill.

However, for automatic special effects, such as simulated perspective, 3-D extrusions, and the ability to distort the outlines of text and pictures, you must look else-where—specifically to *CorelDRAW*'s enveloping function and to the warping feature in *Arts and Letters Editor*. Of course, *FreeHand* does allow you to change the shape of any free-form path—including text that has been converted to curves—but only by manipulating the points and tangent control handles associated with Beziers. *FreeHand* actually gives you great control over freeform paths. You can add specific points to a path with the Curve, Corner, and Connector tools and split a line segment using the Knife tool.

MAC FILE EXCHANGE

As part of the Aldus family, *FreeHand* takes advantage of the same import and export filters used by *PageMaker* and *Persuasion*, which include .EPS, .AI, .WMF, CGM, .DRW, .PCX, and TIFF. Perhaps most importantly, *FreeHand for Windows* can exchange files with its Mac counterpart. This opens up direct access to a world of high-quality illustrations, especially when you consider the large user base that *FreeHand* enjoys in Mac-centric art studios.

FreeHand is tied to the professional art world in other ways as well. The program contains a host of features, including curve flatness, knock-outs for spot color, overprinting functions, and halftoning screens that let you optimize output for a high-resolution typesetter like the Linotronic. With direct access to PostScript fonts, superior typographic functions, and production-oriented output control, it seems clear that *FreeHand* is really aimed at the serious illustrator rather than the casual business-user. ■

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CIRCLE 034 ON READER SERVICE CARD

Microsoft LAN Man 2.1: More Speed, More Enterprise-Wide Support

HANDS ON
by Mikkel Thompson

Novell now has reasons to look over its shoulder. With the release of *LAN Manager* 2.1, Microsoft Corp. has cut deeply into Novell's lead in the network operating system market. *LAN Manager* 2.1 brings significant gains in performance and functionality over its previous version, all for the same list price ($1,995 for a ten-user license) as the *LAN Man* 2.0.

First of all, Microsoft now bundles a copy of OS/2 1.3 that it guarantees will run on over 300 computers. Previously, you had to buy the appropriate version of OS/2 for your hardware separately. Lan Manager, Version 2.1 also provides interoperability with *NetWare* through its NetWare Connectivity Program; DOS and Windows users can simultaneously connect to and access file and print services on both *LAN Manager* and *NetWare* servers.

Windows users will welcome the tighter integration with the Windows environment. During our testing, we logged on to the network and attached network drives successfully from within Windows. We were also able to retain our last shared drives and printers when we exited and returned to the network—a condition called "persistent connections."

In an effort to provide better connectivity into multivendor networks, *LAN Manager* includes TCP/IP as an additional protocol. Basic TCP/IP connectivity comes bundled with *LAN Manager* 2.1, but with Microsoft's optional ($195) TCP/IP utilities, client PCs can easily access other TCP/IP host computers like NeXT or Sun workstations. Furthermore, *LAN Manager* 2.1 servers also report statistical information to both NetView and SNMP management systems, facilitating enterprise-wide network reporting. This report-generating capacity allows the corporate network management system to monitor newly added *LAN Manager* servers.

Microsoft expended great effort to make *LAN Manager* easier to use in a couple of key areas. A DOS client can create a boot disk for computers without hard disks to attach to the network. We quickly installed *LAN Manager* across the network via 3.5-inch floppy disks without difficulty.

LAN Manager's remote-boot process is also greatly improved. Creating a remote-boot image used to be as difficult as installing an old *NetWare* 2.15 server. Now, you simply install the remote-boot ROM and run a menu-driven PM application on the server. We installed the option that allows you to choose between booting either DOS or OS/2. We selected each one separately from the remote boot screen, and they both worked without incident.

Everyone likes speed, and *LAN Manager* 2.1 brings even more of it to the desktop. As our LAN Labs benchmark tests show, Version 2.1 increases throughput on a loaded network by 60 percent over *LAN Manager* 2.0. Microsoft also lets remote users access all *LAN Manager* network resources over a dial-up connection with its *Remote Access Service* ($1,995 per server). For another $995 per server, *LAN Manager Services for Macintosh* lets Macintoshes access network file and printer resources invisibly through the Mac's Chooser. No additional software is required.

But there's still plenty of room for improvement, particularly in the configuration process. On the server, *LAN Manager* should create its own program group in OS/2's Presentation Manager (PM), similar to a Windows program group, with a list of the utility programs available to administrators. Additionally, the character-based administrative utilities should be compatible with PM character-based windowing to allow the administrative tools to run in a window on the OS/2 desktop.

Overall, *LAN Manager* 2.1 is a giant step forward for networking in general and the client-server model of computing in particular. System administrators will appreciate *LAN Manager*'s network management agents and simpler remote-boot facility. And with significant increases in speed and more connectivity options, Microsoft's *LAN Manager* 2.1 turns up the heat on Novell's *NetWare* in the network operating system market. ■

FACT FILE

***LAN Manager*, Version 2.1.** Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 206-882-8080
List Price: $1,995 for 10-user site license.
Requires: 80386 or -486 processor, 8MB RAM, network adapter with NDIS driver.
In Short: Version 2.1 brings TCP/IP, NetWare Connectivity, network management, and faster performance to an already robust network OS.

CIRCLE 435 ON READER SERVICE CARD

BENCHMARK TESTS: LAN MANAGER 2.1

Higher scores represent better performance.	Workstation Throughput Evaluation (kilobits per second)		Hard Disk Access Load (requests per second)
	0 stations	3 stations	3 stations
Lan Manager 2.1	3,302	1,773	271
Lan Manager 2.0	3,072	1,041	237

HOW WE TESTED

We ran PC LAN Labs' benchmark tests on an ALR 486/33 server with 8MB of RAM and a 650MB Core hard disk. The client PCs were 386-based PCs ranging in clock speeds from 20 to 33 MHz.

We juxtaposed the scores of the Workstation Throughput Evaluation test alongside the Hard Disk Access Load test. This clarifies the relationship between the output of the PC running the throughput tests and the overall work done on the network.

WHAT THE NUMBERS MEAN

Performance of LAN operating systems is determined primarily by two factors: high-quality transport-layer software and a good disk cache. *LAN Manager* 2.1 offers slightly better performance than Version 2.0 on a network with little traffic. However, Version 2.1 provides a significant performance increase when the network traffic increases. *LAN Manager* 2.1 uses a more efficient disk cache algorithm on the server, and a faster HPFS—OS/2's High Performance File System. The network shell also hooks the DOS INT21 call, allowing the higher-performance network OS to handle DOS tasks. Finally, Version 2.1 adds a fine-tuned version of NETBEUI, the network protocol, with a sliding window protocol. This permits buffering of requests on the server as well as data to the workstations, resulting in less dead time and greater network performance.

The **Workstation Throughput Evaluation** test reports the throughput recorded on a single PC during the performance of a standardized task on the network, and is run in conjunction with the Hard Disk Access Load test. The test program performs sequential and random reads and writes to the hard disk using a 1MB file. The record size systematically rotates among 16K, 4K, and 512 bytes. The throughput is reported in megabits per second.

The **Hard Disk Access Load** test reads random blocks of data in 1K increments from a 10K file on the server. The results of this test are reported in requests per second for all the PCs running the load test.

We apologize.

What we really meant was:
QEMM-386 makes the most of every last 'K'—automatically. It finds more RAM between 640K and 1 megabyte than DOS 5 or any other memory manager. Lots more.

We under-sold Optimize.
Optimize does everything we said it does, but it manages your memory much more smoothly and quickly than you'd guess from this ad. It checks out virtually every possible combination of memory mapping—automatically.

We under-stated high memory gain.
QEMM-386 finds even more memory than we said—211K additional high memory in most cases. (We wanted to be conservative, but on most PCs, we got over 200K more room for TSRs and drivers between 640K and one megabyte.)

Oops!
When we said that all other memory managers require you to manually re-allocate memory between expanded and extended types, we should have said most memory managers require manual re-allocation, and none find more useable high memory.

We left out Squeeze.
Some TSRs require a lot more memory to start than they do to run. Squeeze increases available memory to accommodate their memory demand, then cuts it back to just what's necessary. The result? You can get more TSRs and utilities out of the way, and eliminate wasted memory.

Then there's VidRAM.
QEMM-386 can use memory set aside for graphics when you only need text. That's up to an additional 96K without rebooting!

Manifest is included, free.
Award-winning Quarterdeck Manifest is included with both QEMM-386 and QEMM 50/60. It's a $60 value that provides information you simply can't get any other way. And it makes memory simple to understand.

Save time; gain performance.
QEMM lets you use the TSRs you want and still leaves lots of room for network drivers, utilities and memory-hungry programs. You'll get fewer "out of memory" messages and get more work done smoothly and quickly.

Apparently this ad was misleading.

Trying not to over-promise, we were too cautious with our claims.

The truth is, QEMM-386 v.6 is better than we made it sound.

Not only does it typically find a lot more memory than we claimed, it also does its memory management job more quickly, smoothly and unobtrusively than we lead you to believe.

Results of running QEMM-386 v.6 with Stealth*

	DOS 3.3		DOS 4.0		DOS 5.0	
Model	DOS Program Size	Avail High Mem	DOS Program Size	Avail High Mem	DOS Program Size	Avail High Mem
IBM PS/2 80	581K	211K	572K	211K	620K	211K
Compaq 20e	581K	211K	572K	211K	620K	211K
ALR VEISA	582K	211K	573K	211K	620K	211K

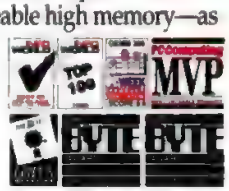
This chart shows how big a DOS program can be and how much high memory is made available when you use our new QEMM-386. Sorry it isn't more colorful.

#1
QEMM is the #1 selling utility according to PC Magazine.

Stealth, our new RAM-gain feature, 'maps' ROM into other areas of memory—to provide you with the maximum available RAM between 640K and 1 megabyte. That's space QEMM then uses to load memory-hogging TSRs and drivers (like network software) out of the memory areas your big programs need.

How it works is not as important as the end result—more useable high memory—as much as 211K!

Our Optimize feature works better, too. From its new interface to the way it works with Stealth to calculate memory usage better, for maximum memory gain.



QEMM has won more recognition than all other memory managers combined.

QEMM-386 helps your programs run faster by giving them more memory. And it works great with any DOS from 3.3 to 5. And Windows, too. It's an essential tool for anyone who wants to get the most productivity out of the hardware and software they're using today.

Quarterdeck

Quarterdeck Office Systems, 150 Pico Boulevard, Santa Monica, CA 90405 (213) 392-9851 Fax (213) 399-3802

* Here we are, being cautious again: Because Stealth alters the memory mapping of your PC, how much high memory you'll gain depends on the 'BIOS' ur computer. We've tested Stealth on a wide range of PCs, from Compaqs to PS/2s; ALRs, Toshibas and many others. Typically, an additional 211K becomes available betwe 0K and 1 megabyte. Depending on your PC, your memory gain may vary.

CIRCLE 338 ON READER SERVICE CARD

Keyfile: Desktop Metaphor Helps Workgroups Manage Documents

HANDS ON
by Henry Ferako-Weiss

Chances are your desktop PC is surrounded by memos, invoices, reports, business cards, and other such hardwood by-products that have been obstacles in the march toward a more paperless office. Document imaging and management systems have typically been quite proprietary, or else they've been a grow-your-own affair.

Keyfile, a software program from Keyfile Corp., runs on a network, uses the standard Windows 3.0 at the PC end, and offers almost complete control over both electronic and paper documents. *Keyfile* lets you keep documents on a computer desktop, file them in electronic folders and cabinets, and control their flow around a workgroup.

The Windows-based program also lets you scan documents, receive them via electronic mail, fax them to colleagues, print them, and add typed, written, or voice annotations. In addition, *Keyfile* lets you orchestrate the work flow surrounding document use.

The software supports a wide variety of printers, scanners, and peripherals, including OCR software, and it makes document management as easy as point-and-click or drag-and-drop. *Keyfile*'s desktop metaphor gives you an icon toolbar with an array of smart icons that resemble a file folder, file cabinet, document, briefcase, scanner, printer, out basket, and so on—over 20 in all.

You can configure each of these icons to suit you, spread them around on your desktop, and drop one on top of another to file, fax, or distribute a document automatically. Drag a document icon over to a folder icon, drop it on top, and the document is now in the folder. Or scan a photograph, attach a yellow post-it-type icon to indicate there's a comment attached, drop it onto the Distribution icon, and send it off to a selected group of people on the network.

Keyfile uses NetBIOS as the network communications protocol, so it's compatible with Novell's *NetWare*, IBM's *LAN Server* or *PC-LAN*, Microsoft's *LAN Manager*, and Banyan's *VINES*, among others. The Document Server portion of the program comes in two versions: The Windows Document Server costs $1,995 and supports up to five users; the OS/2 version costs $4,995 and supports an unlimited number of users. Individual users must have the $995 *Keyfile* Desktop program, which runs under Windows.

Perhaps *Keyfile*'s main feature is its ability to handle paper documents and to perform many tasks nearly automatically. You can use many of the hand-held and desktop scanners currently on the market—including Fujitsu, Hewlett-Packard, and Canon models—as the primary input tool for paper documents, and your desktop can have as many icons as you like to access network scanners and other equipment.

Since each equipment icon has a set of parameters or properties that defines its use, you might have one scanner icon for letter-size documents, one for 5- by 8-inch photographs, and one for business cards—all linked to the same scanner. Then all you have to do is double-click on the appropriate icon for the material you're scanning.

After you've scanned a document, you can use the package's included tool set to scale the image, adjust gray scales, rotate the image, or view a magnified portion. In addition, you can add a title and keywords, and convert the document to ASCII characters with a third-party OCR system. If you want, you can attach typed, written, or voice comments anywhere in the document. (You can also hide comments so they don't clutter the screen.)

FACT FILE

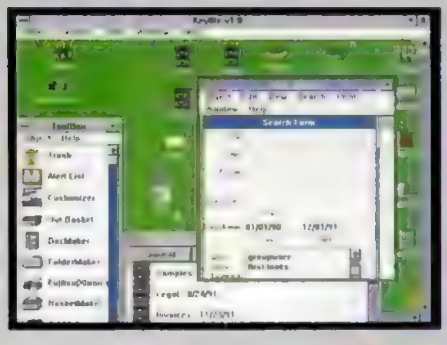
Keyfile
Keyfile Corp., 22 Cotton Rd., Nashua, NH 03063; 603-883-3800.
List Price: For single users, $995; for Windows version of the Document Server, $1,995; for each workstation up to a maximum of five, $995; for OS/2 Document Server, $4,995; for each workstation up to the limit of the network, $995; for MHS Gateway, $995.
Requires: 386-based PC or better; 3MB RAM for the workstation desktop, 4MB for the Document Server; 10MB hard disk space (100MB recommended for standalone use, 60MB per user on separate Document Server installations); Windows 3.0 or later; DOS 3.0 or later.
In Short: *Keyfile* lets you manage all the documents in your office, whether they're paper or electronic, by simply dragging and dropping icons on a graphical desktop. It also gives you a smooth and efficient way to automate the work flow.

CIRCLE 421 ON READER SERVICE CARD.

Keyfile supports *Calera Wordscan Plus* as well as other Windows-based OCR programs. Voice support includes Natural MicroSystems VBX-100 board, Brown-Wagh's Sound Blaster, and Voxlink's Voxlink Voice Server, which is to be available in the first quarter of 1992.

Almost all document-related tasks can be accomplished automatically with the Keyfiler

CONTINUES ON PAGE 48



The *Keyfile* desktop can hold icons for documents, folders, file cabinets, scanners, printers, and fax boards.

To help you create workflow routines, *Keyfile*'s job window displays icons for different steps and lists task prerequisites.

Keyfile gives you a number of ways to file and retreive documents. Here, a table of contents window lists document pages.

Ambulance Car Virus. Ambulance randomly moves across bottom of display.

Friday 13th Virus. Alias "Black Friday." Erases programs when you try to run them.

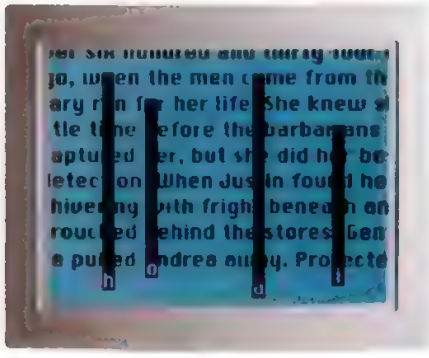
Disk Killer Virus. Alias "Ogre." Causes unexpected formatting of your hard disk.

Stoned Virus. Alias "Hawaii." Data loss caused by damage to directory and FAT.

Datacrime Virus. Adds garbage to files and reformats disk.

AirCop Virus. Alias "Red State." Attacks boot sector on non-write-protected diskettes.

Ping Pong Virus. Alias "Bouncing Ball." Wipes characters off the screen.



Falling Letters Virus. Characters fall to the bottom of the monitor. Creative, but a real nuisance.

With over 50 new viruses each month, who knows what's next.

You Could Get By Without An Anti-Virus Program. Then Again, So Could These.

These days, with networks, modems, laptops, and more and more people sharing files, it's only a matter of time before a virus attacks your data.

PC MAGAZINE EDITORS' CHOICE Oct. 1991

To make sure you get them before they get you, you need Central Point Anti-Virus.™ The only anti-virus program with File Immunization that protects your files so they can never be infected again. Central Point Anti-Virus detects over 800 viruses and destroys twice as many viruses as other programs. It'll even protect you from unknown viruses by searching for suspicious behavior.

It's also the best anti-virus program for protection inside Windows, and it works great across your Novell network.

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CIRCLE 162 ON READER SERVICE CARD

Keyfile

CONTINUED FROM PAGE 46

icon. Just double-click on the icon to initiate a scan of a group of documents, convert them to ASCII, create an automatic keyword list for each one, and then file the documents in a specified file cabinet.

Keyfile has an automatic keyword or indexing feature that works on any ASCII text, indexing every word in the document except for common, repetitive words that are filtered out by the program's Stop Word List. You can add and delete words from the stop list, and all the words on the resulting automatic keyword list can be used later to search for documents. In addition to searching by keywords, you can also search by document title, type, author, description, and date of creation, eliminating the need to worry about DOS filenames or directories.

The program also manages your existing electronic documents by bringing them onto the desktop as imported files or as icons to existing files in your subdirectory. For example, this review appears as an icon on my *Keyfile* desktop even though I wrote the review in *Word for Windows* and stored it in the WinWord/Library subdirectory. When I double-click on the icon, *Keyfile* launches *Word for Windows* and automatically opens the document for me. Furthermore, this icon can be dropped into a folder icon that contains groupware articles and then dropped into a cabinet icon that contains all the *PC Magazine* reviews I write. Whenever I want to look at the document, *Keyfile* launches *Word for Windows*.

Keyfile does not let you index documents in their native format, nor does it let you see a document in its native format without launching the program used to create it. Keyfile Corp. intends to make subsequent revisions work with native file formats more transparently than the current version.

Windows Write, *Excel*, or *Lotus 1-2-3 for Windows* can also be launched from *Keyfile* if the program is specified as part of the document's properties. You can even create your own icon tools and use the Keyfile Open Access Layer to get to dynamic data exchange (DDE) messages and link to Windows application development programs. Using these tools, you can build complex applications that *Keyfile* will launch automatically.

One less obvious but equally powerful aspect of *Keyfile* is its ability to create work flow routines. Using a simple form-fill window, you can create complex jobs that involve a series of steps. Each step has a name, distribution list, prerequisites, allowed responses, due date and alert date, whom to notify upon completion, and a security flag. You can also attach memos and documents to jobs. This aspect of the program makes *Keyfile* a true workgroup solution that enhances the productivity of groups of people working together on projects.

Keyfile represents a step forward in document management. It gives users the ability to automate the handling of both paper and electronic documents. There are still some pieces missing, such as the ability to connect people not directly on a local network and to handle compound documents with full native formatting. The only other factor is price: Keyfile Corp. needs to drop prices in order to make its software more affordable for small and medium-size businesses. ■

Commando Gives You 40 Excel Shortcuts

HANDS ON
by Craig Stinson

Microsoft Excel 3.0 users who have been jealously eying the SmartIcons palette in *Lotus 1-2-3 for Windows* might want to take a look at *Commando*, Black Mountain Software's $49.95 add-in macro. *Commando* invokes a Windows dynamic link library (DLL) that puts a palette of 40 mouse shortcuts on your *Excel* worksheet. By storing the add-in in your XLSTART directory, you can make the palette appear automatically every time you start a spreadsheet session.

Like *1-2-3*'s SmartIcons (and unlike the built-in *Excel* tool- bar), *Commando*'s toolbox can be moved, sized, and minimized. What's smartest about SmartIcons is the fact that you can customize them. You get a default set out of the box, but you can change the palette to make it include only those commands you really need most. *Commando*, in contrast, presents a fixed repertoire of icons. You can change the size, shape, and position of the palette, but not the contents.

Commando has other shortcomings as well. It takes time to learn what each of *Commando*'s 40 icons stands for, no matter how clearly the icons are drawn. (*Commando*'s icons are, however, as self-evident as such things can be.) To get you over the learning hurdle, *Lotus 1-2-3* displays a line of descriptive text whenever you click on one of *1-2-3*'s SmartIcons with the right mouse button. But *Commando* offers no help beyond the manual.

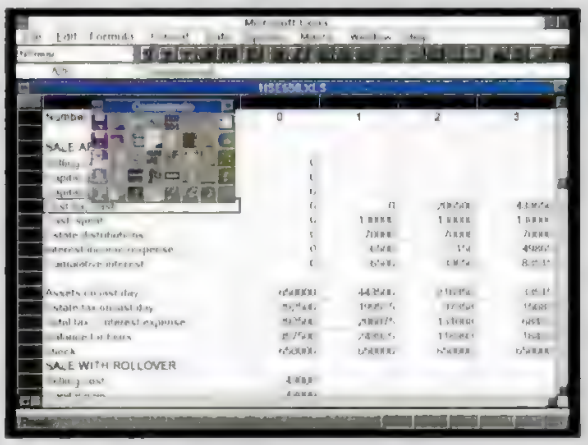
Commando's Options command lets you override the default 8-by-5 layout of the icon palette. But the program insists on making the palette a fully filled rectangle, so if you choose any width that's not an even divisor of 40, you lose a few icons. Now the ones that fall off are all chart-related, so some users won't miss them. But it would be nice if the program warned you. Also, if you choose a width that's too great or too small, the toolbox overreaches the dimensions of your screen, forcing you to drag the box to find your shortcuts. A friendlier product would have added scrollbars to the palette.

Excel developers may find *Commando* an interesting demonstration of what can be done with the program's macro language and DLLs. Users will most likely find it a great source of spreadsheet shortcuts.

Black Mountain Software will have some competition soon; Microsoft itself will most likely respond to the SmartIcon challenge in its next version of *Excel*. An idea as skillfully implemented as this has to show up in competing products. ■

List Price: *Commando*, Version 1.0, $49.95. **Requires:** 286-based PC or better, Windows 3.0, *Microsoft Excel* 3.0 or later. Black Mountain Software, 14870 Penasquitos Ct., San Diego, CA 92129; 619-672-9850.

CIRCLE 422 ON READER SERVICE CARD



With a few caveats, *Commando* gives *Excel* spreadsheets the equivalent of *1-2-3 for Windows*' SmartIcons.

File Edit Worksheet
(C0) [W12]
A:E10 @SUM(B
A B
9
10 Revenues $1,260,000
11 Costs $850,000
12 Profit $410,000
Market Sha
45.0%
30.0%
Why wait any longer!
CALL ZEOS NOW AT 800-423-5891
We have a computer just for you!
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Amipro
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1-2-3® for Windows

Now included in every

For a limited time only, ZEOS Windows systems buyers will also receive Lotus 1-2-3 for Windows plus Ami Pro 2.0, the Lotus Word Processing package for Windows. Complete and fully documented!

Your new ZEOS Windows system includes Microsoft Windows Version 3.0 plus a genuine Microsoft Mouse.

Unbelievable? Believe it! Because now, when you buy any new ZEOS Windows® system, you will also receive Lotus *1-2-3 for Windows* plus Lotus' new word processor for *Windows, Ami Pro™ 2.0* at no additional charge!

It's the ultimate bundle! First, you're going to be receiving the incredible new ZEOS modular system complete with the upgradable CPU of your choice. These new ZEOS systems are the hottest computers money can buy. And that's just for starters.

Because you're also receiving the hottest software money can buy. Yet you don't have to buy it. Because we're including it at *no additional charge.* Go ahead and pinch yourself, it's really true!

And not only are you receiving the *amazing* new Lotus *1-2-3® for Windows* and *Ami Pro 2.0,* you're also getting Microsoft® *Windows* itself, plus a genuine Microsoft Mouse plus Microsoft *DOS 5.0.* All included at one low package price.

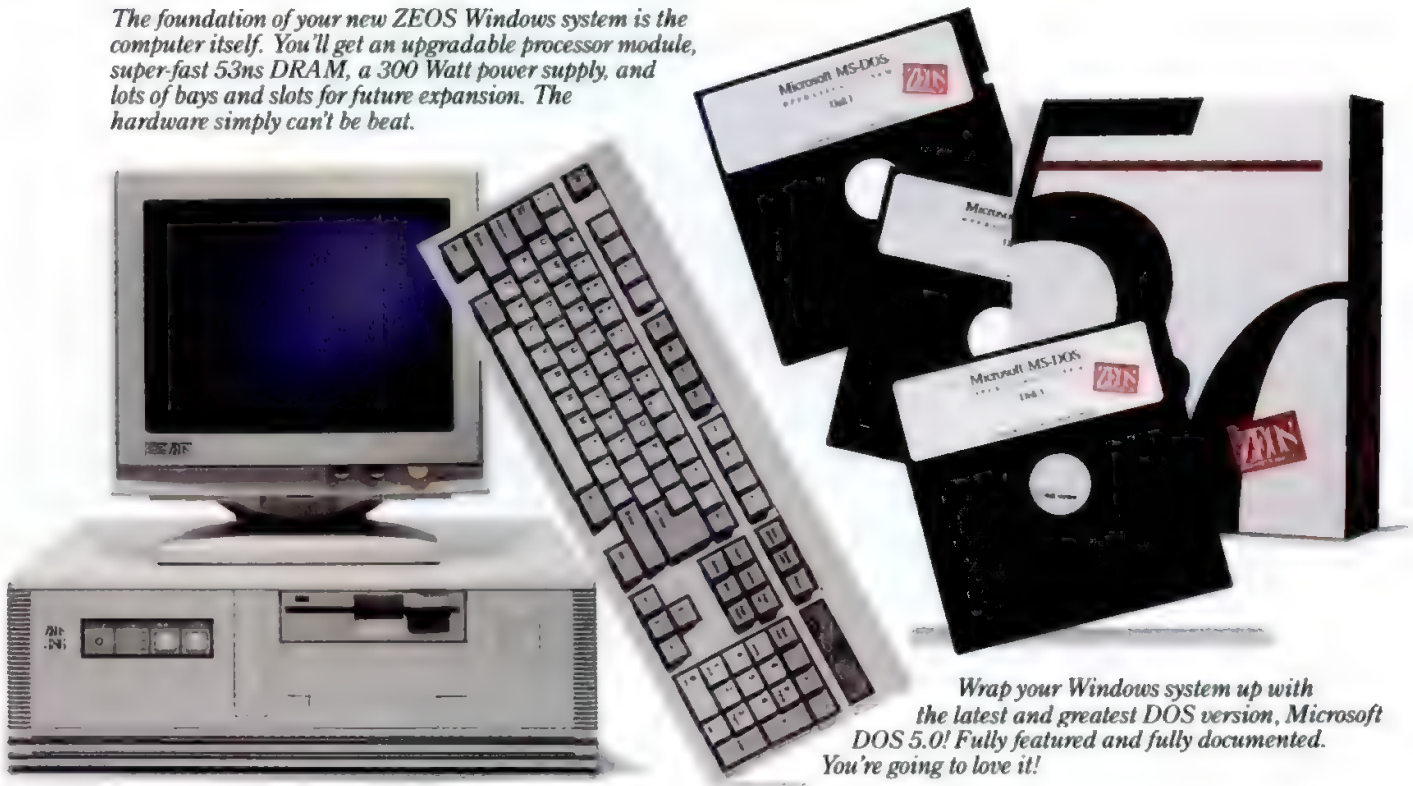
These are not some scaled down versions or trial disks either. They are the *complete* and *fully documented* editions of Lotus *1-2-3 for Windows* and Lotus *Ami Pro 2.0* for *Windows* provided to you by special arrangement between ZEOS and Lotus. This is one incredible value that no one else can offer. You're going to love it, too.

Because nothing else brings out the power of the most powerful software like your blazing new ZEOS system. And when you strap your-

plus Ami Pro® 2.0!

ZEOS Windows System.

The foundation of your new ZEOS Windows system is the computer itself. You'll get an upgradable processor module, super-fast 53ns DRAM, a 300 Watt power supply, and lots of bays and slots for future expansion. The hardware simply can't be beat.



Wrap your Windows system up with the latest and greatest DOS version, Microsoft DOS 5.0! Fully featured and fully documented. You're going to love it!

self in and fire up *Windows* with Lotus *1-2-3* and *Ami Pro,* you're in for the ride of your life!

After all, nobody knows spreadsheets better than Lotus. And when they sat down to write *1-2-3 for Windows* they created a masterpiece. It starts out as a full-fledged *Windows* application. Offering that perfect balance of power and simplicity, it remains fully compatible with all the earlier versions of *1-2-3*. And it's absolutely loaded with new features.

Power, Simplicity, complete Compatibility *plus* loads of new features. It's Lotus *1-2-3 for Windows* and it comes with every ZEOS Windows system. And so does *Ami Pro 2.0!*

After all, *Ami Pro 2.0* is the Lotus word processing program that was designed for Windows from the ground up. Linking with a full suite of Windows applications *including* your new Lotus *1-2-3 for Windows, Ami Pro 2.0* is perhaps the finest word processor on the market today.

Buying your new ZEOS Windows system is possibly the best purchase decision you'll ever make. Then add to it Lotus *1-2-3 for Windows, Ami Pro 2.0* plus *Windows 3.0, DOS 5.0* and a genuine Microsoft mouse. It's an offer that can't be beat and one we simply can't offer for long. So pick your new ZEOS Windows package now and we'll include a bundle! *Call now 800-423-5891!*

Upgradable. High Performance. Low Cost. And every ZEOS Windows system comes with Lotus *1-2-3 for Windows* and *Ami Pro 2.0* at no additional charge. Absolutely incredible!

With ZEOS 386-25s starting at only $1395 right thru '486-33MHz systems starting at $1795, computing will never be the same again! And it's not just the prices that make these new systems hot. It's Performance and Upgradability as well.

UPGRADABLE CPU

When we first sat down to design these new systems, we wanted computers that would *blow the doors off* anything else out there. Plus, we wanted you to be able to upgrade from one CPU to another as your computing requirements changed, *without having to buy an entirely new system.* The results?

Incredibly low cost, high performance systems so very advanced you can move freely from the '386 family of processors to the latest '486s all without a moment's hesitation.

Now, you can pick your power! Today *and* tomorrow. Choose from high speed '386-25 and 33MHz systems, either cached or non-cached, plus the '486SX and '486-33MHz with or without a secondary cache. Whichever you decide upon you know that as your computing requirements change, your processing power can change as

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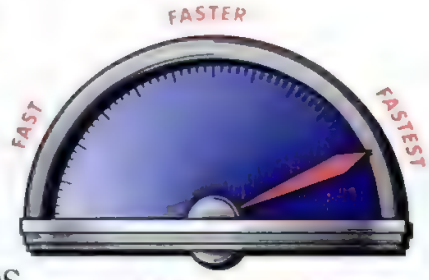
Hot New ZEOS '386

well. But are the prices really that good?

Yes. *Absolutely Yes!* The prices really *are* that good, and the quality too. Because when you buy from ZEOS you're buying directly from the manufacturer. Starting with the main system board, your new computer is designed and built by us right here in Minnesota. That saves money for you. And your ZEOS factory direct advantages are evident not only in the price, but in the performance and quality of your system too.



Z•SPEED METER

To help you select the processor option that's right for you, we have developed the Z-Meter. *The* Z-Meter *shows you the relative performance gains achieved by moving from one processor module to another—fast, faster, fastest! No matter which system you select you can be sure of one thing*—these babies are Hot!

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and '486 systems!

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Eight expansion slots, *seven* of which are available for your future use! After all, expansion and non-obsolescence are what these great new ZEOS systems are all about. We've built in some other very important expansion features for you as well.

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It's your new ZEOS SpaceSaver case! Complete with *seven drive bays,* this incredible case is actually *smaller* than many cases offering only five bays. We've also added *a second whisper quiet cooling fan.* Why? Because whether you expand your system or not, the cooler it

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386-33 $1495
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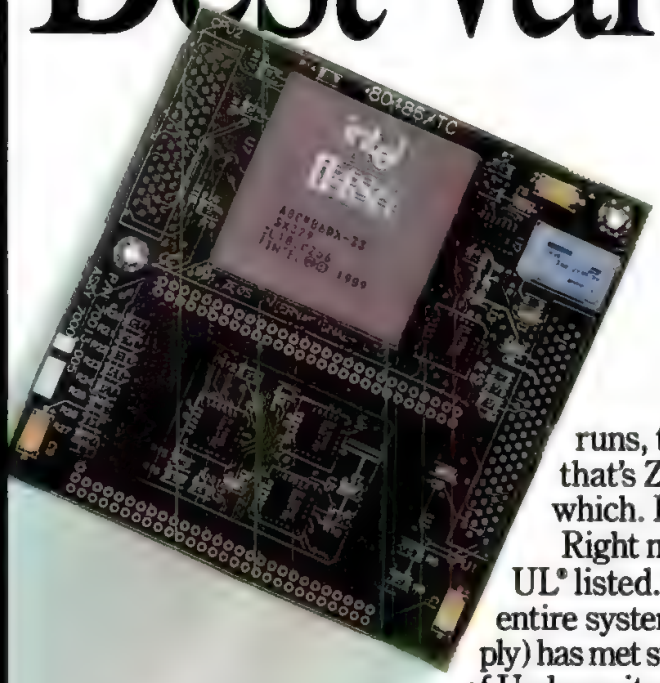
386-33 $2095
386-25 $1995

Best Value!



486-33 $2895
486SX-20 $2695
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486SX-20 $3195
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386-25 $2995

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For Complete Processor and Package Pricing, simply turn the page!

Pick You Package

Or Let Us Custom Build to

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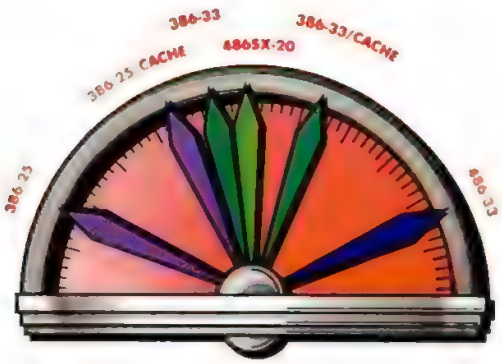

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386-33	$1495	$2095	$2595	$3095
486SX-20	$1595	$2195	$2695	$3195
486-33	$1795	$2395	$2895	$3395

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- ZEOS 14" 1024x768 Non interlaced VGA Color Monitor w/Tilt & Swivel.
- Lotus 1-2-3 for Windows, Ami Pro 2.0, Microsoft Windows, DOS 5.0 *plus* a Microsoft mouse!

PACKAGE #3

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If you're deciding which new computer to buy, there are many important considerations.

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Your #1 Choice!

ZEOS ADVANTAGES:

while others are subtle yet critical to your ultimate satisfaction. We'll go over them here with you one by one.

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☑ VGA color systems feature the high-res ZEOS 1024x768 Non-interlaced monitor with the incomparable Diamond SpeedStar Hi-Color card with 1MB RAM and Sierra DAC (32,000+ colors)!

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☑ Friendly, knowledgeable ZEOS Systems Consultants are available 24 Hours a Day by calling 800-423-5891. You can call any time.

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ZEOS INTERNATIONAL LTD.

Seamless Database Publishing for Windows

HANDS ON
by Alfred Poor

Database programs handle information that fits into fields and records, but they generally don't offer much typographical control. Desktop publishers like *Ventura* or *PageMaker* handle the typographic part of the problem, but formatting data and lists becomes tedious rapidly. A database publishing program that can quickly format data to prepare it for DTP bridges the gap.

Various third-party sources offer database publishing solutions as tack-on products, but now Ventura Software is offering a private-label solution. The $295 *Ventura DataBase Publisher* is Ventura Software's first sortie into the DTP add-on market.

The program has some capabilities specific to working with *Ventura Desktop Publisher*, such as its support for creating tables, fractions, and frame anchors in the text, but it also works with *PageMaker* and *Interleaf*. You simply select the appropriate output file format from a menu.

This brings up a key point about the way *Ventura DataBase Publisher* is structured: All it does is preprocess a data file so that it can be printed using a separate desktop publishing program. The program does not create the *Ventura* layout or stylesheet definitions for you; you need to define the various paragraph tags that are created in the program's output file.

However, saying that it only preprocesses data files is like saying *Lotus 1-2-3* only performs calculations. You have a lot of powerful features behind a visual interface, so you don't have to do any scripting or programming to prepare a file for desktop publishing.

The main program requires that your initial database file is in a *dBASE* .DBF file format, but a separate utility makes it possible to convert text formats (fixed or delimited) to .DBF format. *Ventura DataBase Publisher*'s main screen displays a menu bar at the top, but the eight large buttons in the center of the screen guide you through the various steps so you do not have to learn a sequence of menu commands. The program calls your particular set of rules and configuration options a *recipe*, and recipes can be stored and reused with other data files. All the buttons but the first are initially grayed out (unavailable), so you must follow the sequence step by step. Once you have completed a step, you can return to it to modify your choices.

In its simplest form, a recipe allows you to take a data file, choose which fields you want in the output file, specify record selection and sort criteria, and assign format tags that will be used by the receiving DTP program. The final step, Process Output, produces a text file that contains the data with appropriate tags for the DTP program.

You can also define different levels of group headers based on the contents of fields. Suppose you want to create a company phone directory, with entries separated by department. You would specify the department field as a header that prints only when the department changes. (Note that you need to have the list sorted by department, but the program can do that for you.)

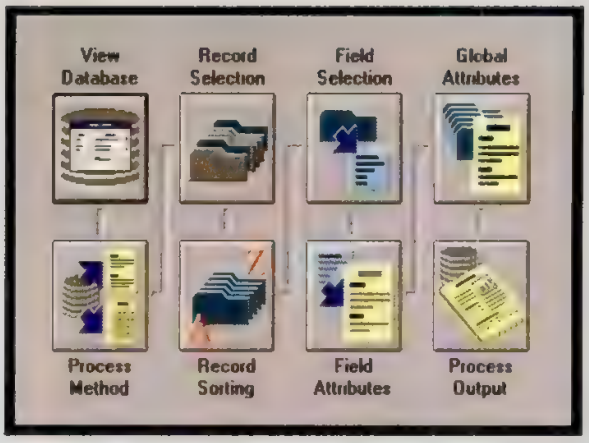
You can also add special text or formatting. For example, you can have it put "Department: " before the department names in the list. There is also an extremely powerful feature called *dictionaries*. Dictionaries are actually more like translation tables, which let the program automatically replace a value it finds in a field with specified text. This is extremely handy for translating abbreviations or codes into meaningful text. If your data file represents departments with numeric codes, you could create a dictionary that assigns "Administration" to code 100. The program is even smart enough to use the dictionary entries for sorting, so that in our example "Accounting" would appear in the directory before "Administration," even though it has a higher department code number.

Assigning format tags is simple. *Ventura Desktop Publisher* makes it easy to use the field name as the tag for each field. You can use your own tag names as well, which can be handy if you want to have different fields share the same print attributes. If you leave a field without any tag, it's treated as a continuation of the prior field.

When you process the file using the recipe, you get a text file output with all the data tagged and ready for *Ventura Desktop Publisher* or one of the other supported DTP packages. Using *Ventura DTP*, you would open the program from the File menu, open the file, and define the various paragraph tags for type style, size, spacing, leading, font weight, paragraph breaks, and so on. The difference between using this procedure and starting *Ventura DTP* from scratch is that the tags are already named; you still have to define them.

While there are many other features, there is also a shortcoming that stands out. The package includes both Windows and DOS character-based runtime utilities that allow you to process a data file using a stored recipe. This would be more useful if you could distribute recipes to others in your organization so that they could process data files on other computers without the expense of buying the full package for every computer. Unfortunately, Ventura Software's license only permits the runtimes on the same computer as the full version.

Originally announced at $695, it is currently $295. At this price, the savings will probably equal the purchase cost on your first project, though a more liberal runtime license would be even more attractive. Ventura also offers the program in a *GEM* version. If you need to create attractive reports based on database information and you use one of the three supported desktop publishing programs, *Ventura DataBase Publisher* is an excellent tool to help get the job done. ■



***Ventura DataBase Publisher*'s main screen has a series of eight buttons that guide you through the process of converting a database file into a desktop publishing file.**

FACT FILE

Ventura DataBase Publisher
Ventura Software Inc., 15175 Innovation Dr., San Diego, CA 92128; 619-673-0172, 800-822-8221.
List Price: $295
Requires: IBM PC AT or compatible, 2MB hard disk space, DOS 3.3 or later, Microsoft Windows 3.0 or later, mouse, EGA or better display; *Ventura Publisher* 2.0 or later, *PageMaker* 3.1 or later, or *Interleaf* (any version).
In Short: *Ventura DataBase Publisher* is an affordable and powerful utility that makes short work of formatting database information for printing with a desktop publishing program.

CIRCLE 415 ON READER SERVICE CARD

A Speedier Adobe Type Manager

HANDS ON
by Christopher Barr

With Version 2.0, *Adobe Type Manager* gets a speed infusion. Adobe Systems' $99 utility, which scales and renders PostScript fonts on the Windows screen and out to any Windows-supported printer, now creates fonts in about 25 percent less time than before.

On PC Labs' tests, *ATM* 2.0 was able to perform in 16 percent less time than Version 1.15 on the File Load test, which measures the time needed to render a screen font for the first time. The new version averaged 27 percent less time on the Type Size Change test, which enlarges a headline from 10 to 24 points. In the Block Typeface Change test, which measures the time needed to convert a paragraph of text from one font to another, Version 2.0 bettered its predecessor by 30 percent.

Adobe achieves these speed gains primarily by using 32-bit instructions when running in Windows' Enhanced mode with a 386 or better CPU. When you start Windows in Enhanced mode, *ATM* automatically installs a 32-bit dynamic link library (DLL), and the *ATM* icon displays "32 bits" in small letters during loading. Standard mode still uses a 16-bit DLL and shows no speed gains.

Other improvements to *ATM* are mostly cosmetic. Initial installation is marginally simpler, and it's easier to pick and choose new fonts to install afterward. The program still doesn't remember the drive or directory from which you previously installed fonts, so you have to select it by hand each time. Like Version 1.*x*, *ATM* ships with four weights each of four typeface families—Times, Helvetica, and Courier, plus a Symbol font.

ATM dominates the Windows market for scalable fonts, partly because of its simplicity and ease of use and partly because you can find almost 10,000 typefaces in the Type 1 font format used by ATM—50 times as many as you can find in any competing format. But Adobe faces a major challenge from TrueType, the font scaling system that has been built into Windows 3.1, due for release early in 1992. TrueType won't need an add-on program like *ATM*, but it will be years—if ever—before the range of typefaces available in TrueType format matches the range available in Type 1 format.

ATM 2.0, meanwhile, works smoothly with the beta version of Windows 3.1 tested by PC Labs. We were able to mix both *ATM* and TrueType fonts in the same document with no difficulty.

In a preemptive strike against TrueType, Adobe has been aggressively bundling *ATM* with a number of Windows products from Aldus, Lotus, Micrografx, and Ventura. To further advance its market share, Adobe is charging only $20 for the upgrade to 2.0. The speed gain easily makes it worth the price. ■

List Price: *Adobe Type Manager*, Version 2.0, $99; upgrade for Version 1.*x*, $20. Adobe Systems Inc., 1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039-7900; 800-833-6687, 415-961-4400.

CIRCLE 431 ON READER SERVICE CARD

Fastback Plus: Faster Performance, Different Interface

HANDS ON
by Edward Mendelson

Version 3.0 of Fifth Generation Systems' $189 *Fastback Plus* brings faster speed, greater flexibility, and a new interface to this classic backup program. No one will complain about extra speed, but upgraders may be baffled by interface changes that make the new version look completely different from the old. As compensation, *Fastback* can now back up multiple drives without using a macro, offers encrypted backups and a TSR scheduler, and lets users of Novell's *NetWare* back up and restore user privileges along with files.

In informal tests, *Fastback Plus* now works as quickly as *The Norton Backup* and *Central Point Backup* (which also comes included with *PC Tools*). Unlike these programs, *Fastback* doesn't give you a matching Windows version, although you can run it in a DOS session under Windows. Unlike *Central Point Backup*, *Fastback* can't work with tape drives, although tape support is promised for a new version soon.

Fastback's new interface looks like a character-based version of Windows. It even has an Edit menu that includes Cut, Copy, and Paste commands that you can use when modifying keystroke macros or transferring part of one macro into another. You can choose among three menu levels, but even the simplest is often confusing. For example, in the box that lets you decide whether to back up all files, changed files, or files you choose, the "Files I choose" option disappears if you select one of the other options, and you have to move elsewhere on the menu to get it back. The keyboard is inconsistent, and you have to drag with the mouse when a click should be enough.

Some options on the advanced menu may be comprehensible only to engineers, who will understand that "Begin with dismount" doesn't mean you have to get off your horse, but that you have to start a backup with a new disk. A help screen explains all options, but comes up blank when invoked from some submenus. The manual is complex and obscure, but a simplified User Guide covers basic functions and you can call for toll-free support day or night.

Some options from Version 2.*x* have disappeared; for instance, one that let you tone down the loud error beep. The first release of Version 3.0 couldn't restore backups made with Version 2.09 or earlier, but Version 3.04 can.

Fastback Plus gets the job done, but if you plan to upgrade from Version 2.*x* you'll get a virtually new program. It may be time to consider instead *The Norton Backup*, *PC Magazine*'s recent Editors' Choice, or, for tape and floppy disk support, *Central Point Backup*. ■

List Price: *Fastback Plus*. $189. **Requires:** 640KB RAM, DOS 3.0 or later. Fifth Generation Systems, 10049 N. Reiger Rd., Baton Rouge, LA 70809; 800-873-4384, 504-291-7221.

CIRCLE 434 ON READER SERVICE CARD

Fastback Plus **lets you select files by defining and selecting file groups with plain-language names like "database files" or "WordPerfect files."**

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"Best application software in customer satisfaction in Small to Medium-sized and Large Businesses"

Borland leads the way. Borland is committed to advancing the dBASE standard on multiple platforms – DOS, Windows, VAX VMS, Sun, UNIX and Macintosh.

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CODE MP26

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CIRCLE 295 ON READER SERVICE CARD

QuickShow! Supports Hi Color Graphics

QuickShow! works with high-color cards to display photographic-quality images in 32,768 colors at up to 800-by-600 resolution.

HANDS ON
by Paul Bonner

Most PC-based presentation packages support the standard 16 or 256 colors. HSC Software's $149 *QuickShow!* presents a more realistic picture.

QuickShow! is able to reach what is called "high color," thanks to its support for the 32,768-color mode of Super VGA graphics boards that use Sierra Semiconductor's Hi Color Palette DAC chip. High-color boards are available from ATI, Cardinal, Diamond, and others. Completed *QuickShow!* presentations are impressive, but the program's lack of full-fledged Windows support makes the road to getting there rather clumsy.

In addition to incorporating high-color images in 16-, 24-, or 32-bit TGA (Targa) format, you can also import 1-, 4-, 8-, and 24-bit .PCX and .BMP files, .GIF files, 24-bit TIFF files, as well as *Animator Pro* and *Autodesk Animator* files.

You build a desktop presentation in *QuickShow!* by assembling the names of preexisting graphic, sound, and animation files into a Script Editor, adding transitions, and then playing back the script. *QuickShow!* provides simple tools for specifying the display time and transition effect (from a choice of over 100 high-quality transitions) for each image, and for adding a digitized sound track using .VOC (Sound Blaster format for digitized voice) or .WAV (Windows' audio file format) sound files in conjunction with a Sound Blaster, Media Vision, Pro Audio Spectrum, Thunderboard, or a compatible sound card. With the sound card, the program can also record digitized voice sound tracks.

One infuriating aspect of *QuickShow!* is its lack of full Windows support. Only the *QuickShow!* editor actually runs under Windows, and then only in Real mode, or in both Real and Standard modes if you're using Quarterdeck Office Systems' memory manager *QEMM-386*. Windows' 386 Enhanced mode is not supported at all. We also had trouble using memory managers other than *QEMM-386*.

The editor has to open a DOS command session to execute full-screen DOS utilities whenever you ask it to do anything remotely connected to presentations, be it viewing an image, previewing a sound, or playing a presentation. The net effect of Windows is to slow down the whole process. Fortunately, there's also a DOS-based show editor. HSC promises that a future version will run entirely in Windows and will work with 8- and 16-bit cards, as well as the high-color display adapters.

There are a few other aspects of *QuickShow!* that might raise your blood pressure, such as the lack of a free runtime module and an inability to compensate for hardware differences between the creation machine and the playback machine. Both machines must be configured identically, even down to CPU and disk speed and directory structure.

While these limitations cannot be underestimated, *QuickShow!*'s simple but effective presentation editing tools and unmatched display quality make it a straightforward tool for creating attention-getting multimedia presentations. ■

List Price: *QuickShow!*, Version 1.0, $149. **Requires:** 286-based PC or better, 640K RAM, 20MB hard disk, 1MB EMS, Super VGA card with S3/Sierra Hi Color RAMDAC, DOS 3.2 or later, mouse (Windows 3.0 or later required for Windows editor). HSC Software, 1661 Lincoln Blvd., #101, Santa Monica, CA 90404; 310-392-8441.

CIRCLE 427 ON READER SERVICE CARD

Intelligent Parallel Port Speeds Print Jobs

HANDS ON
by Joe Salemi

CPUs have become more powerful, and hard disks are faster, yet even the fastest 486 system is not much better than a lowly 8088 in one important respect: the speed at which it sends a print job out the parallel port. Various methods of speeding up the process and returning control to the application exist but have drawbacks. Software print spoolers take up precious RAM that's better used to speed up the application itself, and external print buffers add to desk clutter without doing anything to speed up the actual data transfer.

Interface Electronics has a solution: the $199 StarBoard Port, an intelligent ISA parallel port board that's actually a coprocessor. More than just a print buffer, the StarBoard comes with 256K of on-board RAM and a Motorola MC68HC11 CPU, which is the key to how the board speeds up printing. As long as there's room in the buffer, the board keeps accepting data from the PC and never reports the printer as being busy, so applications return faster from printing. The CPU also compresses the data prior to storing it in the buffer, virtually doubling its capacity. Though we didn't test it for this review, the on-board circuitry can drive parallel cables up to 500 feet in length, a significant increase over the capability of standard parallel ports.

The StarBoard Port is a half-size 8-bit card that fits in any XT- or AT-class slot, and installs as easily as any standard printer port card. Two jumpers control the port and IRQ selections. The on-board RAM can also be user-upgraded by replacing the 256K SIMM with a 1MB SIMM. Otherwise, the board appears to the PC as a standard parallel port.

The board worked well with a number of DOS applications that I tested it with, including *Alpha Four*, *dBASE IV*, *Lotus 1-2-3* 2.01a, and *WordPerfect* 5.1. I was also able to copy files to the printer from the DOS prompt. Applications returned from print spooling jobs at least twice as fast as when printing to a standard port. The board worked particularly well with Windows 3.0; I saw a lot less of the hourglass when spooling large jobs. I did encounter problems printing through both OS/2 1.3 and the latest OS/2 2.0 beta; Interface Electronics promises to have them resolved by the time OS/2 2.0 is officially released.

The company is also in the process of developing a *NetWare* 3.11 NLM (*NetWare* Loadable Module) that will let a network administrator remotely reset the board and pause/resume print jobs.

If you're tired of waiting for your computer to finish its printer chores, take a look at the StarBoard Port. Windows users and those who need to print large graphics files will find the board's cost is more than offset by the productivity gain. Owners of slower 286 and 8088 systems will also find the increased printing speed appealing. ■

List Price: StarBoard Port, $199. **Requires:** 8-bit or 16-bit ISA slot, DOS 3.0 or later. Interface Electronics Inc., 4579 Abbotts Bridge Rd., #8, Duluth, GA 30136; 404-623-1066.

CIRCLE 420 ON READER SERVICE CARD

Introducing Borland's ObjectVision 2.0 Instant Business Software!

New ObjectVision™ 2.0 is the easiest way to create your own Windows software applications. Fast. In fact, if you own Windows, you need ObjectVision to build software that is custom tailored to your specialized job or process. And ready-to-go applications are even included free, making it easy to get started.

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ObjectVision uses a revolutionary concept in software called *visual programming*. This unique technology enables *anyone* to create interactive Windows applications without programming! Plus, you get instant access to your business data, no matter where it resides. So you are always informed.

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- New Event Trees give you complete control over your application
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- Password protection
- One-to-many data relationships
- Free runtime included!

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Instant Savings!

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See your authorized dealer today, or call now 1-800-331-0877, Dept. 5118

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*Offer ends March 31, 1992. Rebate available for product purchased through dealer only. Obtain rebate card from dealer at time of purchase. Dealer prices may vary. All prices are in U.S. dollars. All Borland products are trademarks of Borland International, Inc.
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CIRCLE 287 ON READER SERVICE CARD

Windows Brings Added Dimension To The Writer's Toolkit

HANDS ON
by Jonathan Matzkin

Clear, effective writing is an essential business skill, but the average office memo or project proposal is riddled with grammar lapses, spelling errors, and clumsy language. That's really too bad, since almost anyone can learn and practice good writing habits.

The Writer's Toolkit for Windows, from Systems Compatibility Corp. ($129), combines a grammar-checking program with six reference tools (dictionary, thesaurus, quotation dictionary, abbreviation dictionary, encyclopedia, and grammar manual) that could be a big help to conscientious business writers. The Windows interface integrates *Toolkit* with popular word processors and places its reference modules at your fingertips as you work on a document.

Toolkit's main screen looks a bit like the Windows Program Manager. Icons arranged along the bottom of the screen correspond to the individual *Toolkit* components. To open the dictionary, for instance, you click on the appropriate icon. Each tool runs in a window, and you can open multiple tools in separate windows.

One of *Toolkit*'s best features under Windows is its Synchronize All menu option. Once invoked, this command automatically looks up your entry in all of the currently active modules. In this way, you could seek a definition, synonyms, and background information for the same entry in a single operation. The results are displayed in each open window as if the search term had been entered separately in each component.

Systems Compatibility includes macros that virtually make *Toolkit* a part of *Ami Pro*, *WordPerfect for Windows*, or *Word for Windows*. I installed the *Toolkit*'s *WinWord* macros (the *Ami* and *WordPerfect* macros weren't yet available) and they worked beautifully. Once installed, the macro is triggered by *WinWord*'s macro/run command. You can check a document or use any of the reference modules without leaving *WinWord*.

I also used *Toolkit* in conjunction with *XyWrite*, which I run in a DOS session under Windows. Even though Systems Compatibility Corp. provides no specific links to *Xywrite*, I found *Toolkit* to be a convenient companion to my word processor. I simply ran the word processor and *Toolkit* in separate on-screen windows and switched between them as necessary.

As individual tools, none of *Toolkit*'s components equal their traditional, book-form counterparts. And grammar-checkers, as a group, simply don't work very well. The English language, in its seemingly limitless complexity, defeats all attempts at reducing it to a software-based system of rules. In our last roundup of writer's tools (September 24, 1991), the best of the grammar-checkers, *Power Edit*, found less than half of the mistakes in our test file. *Correct Grammar*, the grammar-checking component of *Toolkit*, came in second but found only 35 percent of the errors. *Toolkit for Windows* found no problems with the following sentence: "Another method Bill uses are to use persuasion." Grammar-checkers do consistently catch some mistakes, but they are nowhere near as reliable as a competent spell-checker.

Grammar-checking is not a good reason to buy *Toolkit*, but the package's other components have quite a bit to recommend them. The *American Heritage Electronic Dictionary* has more than 115,000 entries and offers reasonably complete definitions. It's not as comprehensive or as complete as the unabridged *American Heritage Dictionary of the English Language* that I got as a childhood present, but it serves quite well for most quick lookup needs as you work on a document.

Similarly, the included version of the *Concise Columbia Dictionary of Quotations* is a ready source of pithy comments from the likes of Harry Truman, Winston Churchill, and Dorothy Parker. You can search among the 6,000 entries on a particular topic or person, or view an index of all authors and subjects.

The *Dictionary of Common Knowledge* is analogous to a one-volume encyclopedia. Entries are short and not terribly informative, but this module will help you keep your facts straight. The abbreviation dictionary is designed to serve a specific, limited purpose. It tells you the appropriate abbreviation for a word, if one exists, and it also expands abbreviations into their long form.

Also included and of more use than this limited tool is *The Written Word II*, an on-line handbook of grammar and style. A fairly comprehensive textbook, *Written Word* displays its table of contents when you click on its icon within *Toolkit*. You can search for a topic using keywords, as with the other modules, or browse the table of contents and click on a desired topic. For someone like me, who must constantly be reminded not to write passive sentences, having an on-line grammar reference is a major convenience.

One legitimate complaint about *Toolkit* is its speed. Running on my 486/33 it was a bit slow opening and closing, and occasionally slow in finding a reference. Systems Compatibility promises a speed-up patch that should improve performance.

Anyone who does a significant amount of writing will have use for *The Writer's Toolkit for Windows*. The ready accessibility of its information gives this software a distinct advantage both over non-Windows packages and over actual books. The references aren't as complete as those in book form, but the convenience and flexibility of *Toolkit* goes a long way toward making up for its deficiencies as a reference work. ■

***The Writer's Toolkit* makes excellent use of the Windows 3.0 interface. The Synchronize All command allows a single key word to be looked up simultaneously in multiple references.**

FACT FILE

The Writer's Toolkit for Windows
Systems Compatibility Corp.,
401 N. Wabash, #600,
Chicago, IL 60611;
312-329-0700.
List Price: $129.
Requires: 80286 or better processor, 6.5MB of hard disk space, Microsoft Windows 3.x.
In Short: A collection of useful writer's tools ingeniously knitted together under the Windows environment. Not as comprehensive as standard book-form reference tools, but much more convenient to access.

CIRCLE 432 ON READER SERVICE CARD

How Borland's Paradox Is Making News in the USA . . . TODAY

USA TODAY® has changed the way Americans look at newspapers. As "The Nation's Newspaper,"™ *USA TODAY* goes after critical, in-depth stories that affect people across the country.

But because many of those stories start with mountains of numbers and statistics, getting the facts is a difficult, time-consuming task. And in the deadline-oriented newspaper business, there is simply no time to waste.

To solve these complex problems, *USA TODAY* chose Borland's Paradox.®

The Dawn of "Database Journalism"

USA TODAY's Special Projects Unit has the daunting task of gathering and analyzing various government reports and statistics to get to the important stories hidden underneath.

They call their work "database journalism," and Paradox is the tool of the trade.

Reporters download information—from census figures to campaign finance data to crime statistics—into specially created Paradox databases for easy searching and analysis. In many cases, Paradox imports these figures directly, since it reads dBASE® and Lotus® files.

The S&L Scoop

In fact, Paradox and database journalism were key figures in *USA TODAY*'s groundbreaking series of reports on the Savings & Loan crisis.

Early in 1989, *USA TODAY*'s Special Projects Unit used Paradox to investigate and analyze the health of more than 3,000 S&Ls across the country. As a result, *USA TODAY* readers were among the first to know about the national ramifications of this important story.

A Messenger Called AMANDDA

USA TODAY has 29 bureaus and regional offices nationwide. The paper's production depends on all those offices sharing messages and vital information.

To handle this information flow, a system called AMANDDA (for Automated Messaging AND Directory Assistance) was created using Paradox to work with the corporate electronic mail system. This remarkable partnership links every *USA TODAY* office, and provides instant access to a variety of information sources, the lifeblood of a daily newspaper.

And with Paradox, AMANDDA was up and running in less than two months.

Just the Facts

Paradox has all the powerful database features you need. Features like superior single- and multiuser access. Query By Example (QBE) to simplify finding the information you're looking for. Presentation-quality graphics for outstanding reports. The turbo-driven VROOMM™ system for maximizing memory use. Multi-table forms that let you look simultaneously at information from several tables. And that's only the beginning.

For developers, Paradox includes the comprehensive Paradox Application Language (PAL™). PAL puts the power of Paradox at your fingertips, and a set of robust development tools completes the programming environment. Exactly what you'd expect from a world-class database management system.

Some Independent Opinions

Some of the most respected industry publications have also made Paradox their #1 choice.

"With its combination of speed, ease-of-use, and practical features, Paradox [is] an excellent value."
—*Computerworld*
April 8, 1991

"Paradox is an outstanding product for developers and end users. It's one of the finest combinations of programming and interactive environments available."
—*InfoWorld*
November 12, 1990

Get Paradox. And Get the Whole Story.

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CIRCLE 031 ON READER SERVICE CARD

TypeReader: OCR Software That Captures the Details

A newcomer to the scene, ExperVision's $895 *TypeReader* is going head to head with the current leaders in the Windows-based optical character recognition (OCR) arena: Calera's *WordScan Plus* and Caere's *OmniPage Professional*. Unlike the competition, *TypeReader* does not handle graphics. Instead, its designers have focused on producing software that claims to achieve superior speed and accuracy. Its ability to capture the format as well as the content of original documents sets it apart.

Designed to read alphabets such as Japanese Kanji, which has over 7,000 symbols, *TypeReader* uses a technique known as machine-learned fragment analysis, based on thousands of type samples pinpointed with the stable elements of each character for identification. The resulting engine performs *TypeReader*'s primary OCR. A series of filters are then used to overcome recognition obstacles such as fragmented letters, kerning, and unusual fonts. Other programs in this class use feature extraction or omnifont technology, and most low-end programs use a more limited matrix matching technique.

TypeReader can also completely preserve the source document's format. Other high-end OCR programs retain some format information such as tabs, indentations, bold, underline, and italic fonts, but *TypeReader* also preserves font type and size (from 5 to 64 points), columns, and justification.

From *TypeReader*'s Windows-based setup, you specify the output format, the directory where files will be loaded, and the scanner you'll use. Drivers for Abaton, Canon, Datacopy, Epson, Hewlett-Packard, Howtek, Microtek, Panasonic, Ricoh, and UMax scanners are included. *Adobe Type Manager* 1.5 is bundled, but its use is optional.

The simple interface places scanner controls and import functions on a set of button bars called the Gallery. The scrollbar along the bottom controls the document's magnification, position, and mode: either the original bitmap version or the converted OCR version. Menus access file operations, preference settings, and advanced operations.

Your source documents can come from existing bitmap files in TIFF or .PCX format or scanned images. Clicking on the Gallery's Auto button runs the program through three recognition phases: Get Page, Locate, and Recognize. You can also run the steps manually. The source file is loaded into memory, and a bitmapped image of the file is displayed with a bar depicting progress. Next, the bar moves over the page, locating the blocks of text and drawing arrows in the order they will be processed. Finally, the bar moves down the page during the actual OCR recognition process. A dictionary automatically checks spelling.

With the converted, formatted document displayed, you can do on-screen editing using the Tab key to move to unidentified or questionable letters. The original scan of the words in question pops up for quick reference.

You can save the file in *Ami Pro*, *DisplayWrite* (DCA/RTF), *Excel*, *Lotus 1-2-3*, *Microsoft Word* (RTF), *MultiMate*, ASCII, or Smart ASCII formats. All except the plain ASCII option will save any supported document formatting.

To test ExperVision's claims informally, we ran a series of pages through *OmniPage Professional*, *TypeReader*, and *WordScan Plus*. Samples included a variety of fonts, mixed columns, poor-quality faxes, books, and yellowed newspapers.

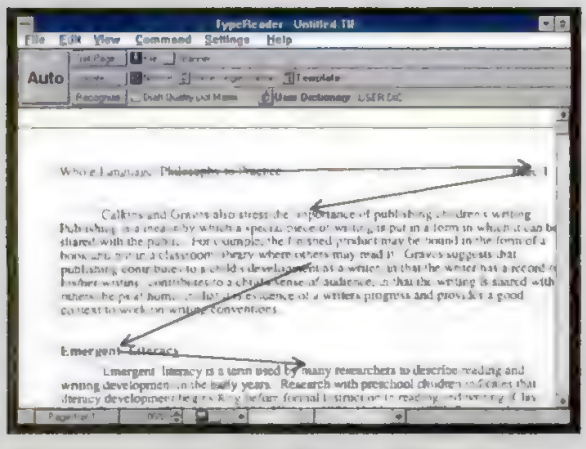
TypeReader handled complex layouts well and was better than the others at recognizing decorative and stretched fonts. We used the program's defaults to read a page with several fonts in varied sizes (alternating between one and two columns), saved the unproofed file, and printed it using *Word for Windows* 2.0. All formatting was preserved correctly except for two minor errors—a missed hyphen and letter. A complex table scanned from a light photocopy with five columns of figures and one column of text was read and loaded into *Excel*. We found only one missed letter and one misplaced cell.

TypeReader handled text close to the spine of a book more accurately than competitors. A dark fax foiled all three programs (about 40 percent errors), but *TypeReader* processed the page in about 25 percent less time.

The amount of available memory makes a real difference in *TypeReader*'s conversion speed. On a 386/SX with only 4MB of memory, *TypeReader* was actually slower than the other programs. On a 386-based PC with 12MB of RAM and on a 486-based PC with 16MB of RAM, it showed slight gains on processing easy pages (taking about 5 percent less time than the other programs) and a significant gain on complex documents (20 to 25 percent less time). *TypeReader*'s edge increased to about 30 percent when it ran on a 486-based PC with 16MB RAM. In short, *WordScan Plus* outperforms *TypeReader* on high-quality documents using machines equipped with low memory. *TypeReader* shows definite advantages with tough tasks and with more memory.

The only bug we noticed was *TypeReader*'s tendency to cut the ends off some character strings. This appears to result from the way it measures fonts when the space is calculated for the frame that contains the text. Adjusting the font-mapping option in the Setting menu to match the fonts used by the video adapter fixed the problem. ExperVision is working on a fix for the next release.

With its slick interface, enhanced ability to capture formatting, and thorough documentation, *TypeReader* is a strong showing for a first release. It requires more memory and a little more money than some of the other programs, but the extra power and features make it well worth serious consideration. ■



TypeReader provides an easy-to-use interface for sophisticated OCR. It offers a high level of accuracy and the ability to save the format of the scanned document (shown here) in the converted file.

FACT FILE

***TypeReader*, Version 1.0**
ExperVision Inc., 3590 N. First St., San Jose, CA 95134; 800-732-3897 408-428-9444
List Price: $895.
Requires: 286-based PC or better, 4MB RAM (6MB recommended), 8MB hard disk space, DOS 3.1 or later, Windows 3.0 or later, mouse.
In Short: A very powerful, well-designed Windows-based OCR package that not only does a superb job of handling text conversion but can also preserve the formatting of the original document.

CIRCLE 418 ON READER SERVICE CARD

NEW

Borland ranked best Quattro Pro beats Lotus 1-2-3

Two recent industry studies objectively confirm the facts: Customers rank Borland best among software companies, and Quattro® Pro outperforms *all* Lotus® spreadsheets.

Borland: The technology leader.

Buying software shouldn't be an act of blind faith. Before purchasing your next spreadsheet, take a hard look at the company behind it. Bigger is not better!

Because Borland is smaller than our competitor, we work smarter, we try harder, and it's paying off: Borland was just ranked "Best Application Software in Customer Satisfaction, in Small and Medium Sized Businesses," in the prestigious J.D. Power and Associates survey.

Who would you rather buy your next spreadsheet from?

J.D. POWER AND ASSOCIATES

APPLICATION SOFTWARE
CUSTOMER SATISFACTION INDEX℠

June 6, 1991

1. BORLAND
2. WORD PERFECT
3. CLARIS
4. ALDUS
5. MICROSOFT
6. LOTUS

Quattro Pro: The standard of excellence.

InfoWorld reviews confirm what more than one million PC users already know: Quattro Pro is the best DOS spreadsheet that money can buy. Better than *any* Lotus spreadsheet including their recently released version 2.3.

Just check out the *InfoWorld* review results below. Quattro Pro wins in comparison to Lotus 1-2-3® hands down in *InfoWorld* and with more than 1,000,000 enthusiastic users.

Number of ...	Quattro Pro 3.0[1]	Lotus 1-2-3 v. 2.3[2]	Lotus 1-2-3 v. 3.1[3]
"Excellent"	7	2	3
"Very Good"	8	4	5
"Good"	0	5	4
"Satisfactory"	2	5	3
"Poor"	0	1	1
Overall score	**8.4**	**6.3**	**6.5**

[1] Source: *InfoWorld*, April 29, 1991. [2] Source: *InfoWorld*, June 10, 1991.
[3] Source: *InfoWorld*, January 28, 1991

REPORT CARD — INFO WORLD

SPREADSHEET SOFTWARE
Quattro Pro
VERSION 3.0

Criterion	(Weighting)	Score
Performance		
Formulas/analysis	(100)	Very Good
Compatibility	(50)	Very Good
Speed	(75)	Very Good
Database	(75)	Excellent
Graphics	(75)	Excellent
Output	(50)	Excellent
Macros	(50)	Very Good
Consolidation/linking	(50)	Excellent
Capacity	(50)	Very Good
Network	(50)	Satisfactory
Documentation	(50)	Excellent
Ease of learning	(50)	Excellent
Ease of use	(75)	Very Good
Error handling	(50)	Very Good
Support		
Support policies	(25)	Very Good
Technical support	(25)	Satisfactory
Value	(100)	Excellent
Final score		**8.4**

We don't blame Lotus for trying to underplay ratings such as these, but clearly Quattro Pro is more powerful. It has better graphics, better capacity, better macros, better consolidation and linking, and much more!

Borland and Quattro Pro: The obvious choice.

Company for company, product for product, the choice is clear. Join more than a million users and upgrade to Borland's Quattro Pro today! If you own any version of Lotus 1-2-3, for only $129.95 we'll rush you your own copy of the best spreadsheet from the best company.

See your dealer or call 1-800-331-0877 now!

PC MAGAZINE EDITORS' CHOICE OCTOBER 1989 · PC Computing MVP MOST VALUABLE PRODUCT · 1990 BYTE AWARD OF EXCELLENCE · weNEB PRODUCT OF THE YEAR 1990 · INFOWORLD BEST IN ITS CLASS

B O R L A N D

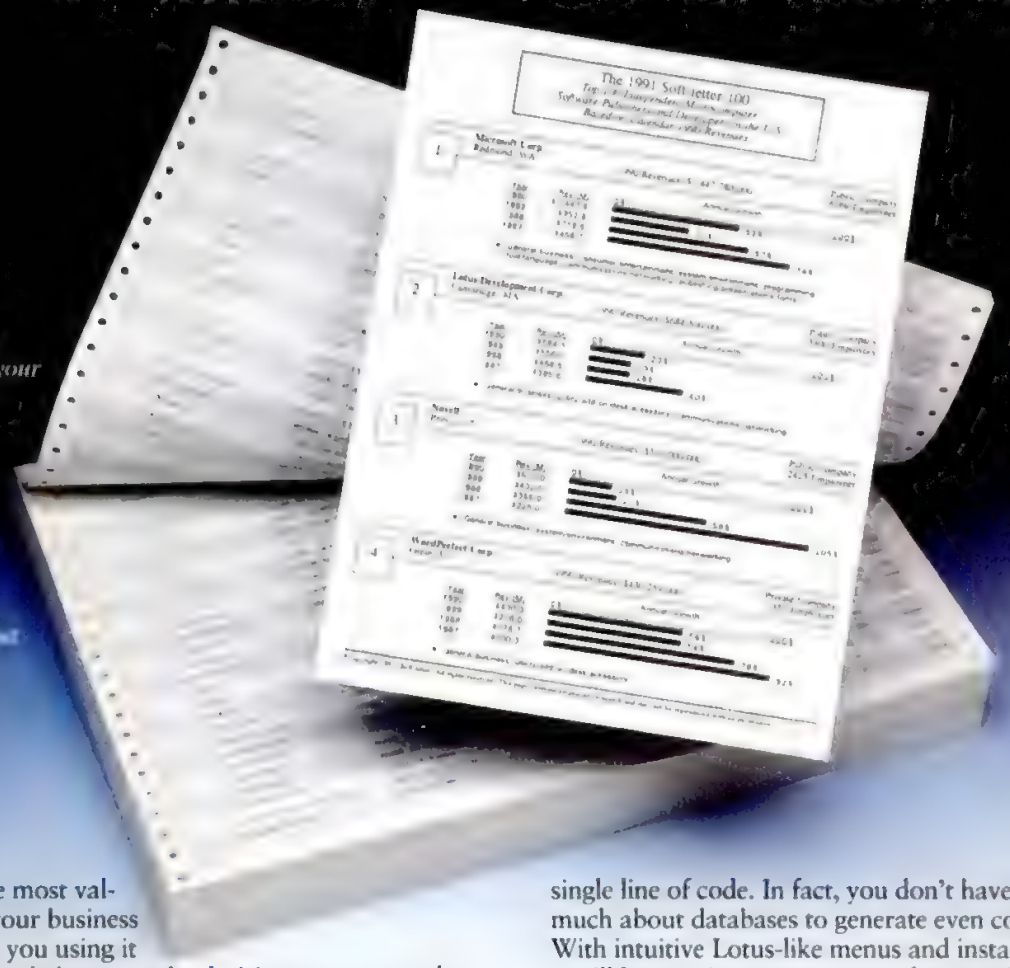
Software Craftsmanship

CODE: MJ59

1991 J.D. Power and Associates Computer End User Satisfaction Study: Phase I, Office Based Small to Medium Sized Businesses℠ Response from Business End Users at 1,784 business sites. Small to medium sized businesses were based on office sites with between 1 and 499 employees. J.D. Power and Associates is a service mark of J.D. Power and Associates. Borland is a registered trademark of Borland International, Inc. Copyright © 1991 Borland International, Inc. All rights reserved. Quattro is a registered trademark of Borland International, Inc. Pricing is in U.S. dollars. Offer good in U.S. and Canada only. Dealer prices may vary. BI 1429A

CIRCLE 285 ON READER SERVICE CARD

Turn your data into information.



R&R Report Writer turns your raw data into useful information. Create reports that relate, analyze, summarize and professionally present your data

You need R&R if you use:
dBASE
Paradox
Fox
Alpha Four
Clipper
1-2-3
Quattro Pro

Data. It's the most valuable asset your business has. But are you using it effectively... to help you make decisions to grow and manage your business?

Now there's a way to get the most out of your data.

R&R Report Writer lets you take the data stored in your database files and turn it into comprehensive, easy-to-understand reports. Using these reports, you'll be better able to analyze trends in your business, make informed decisions and increase your overall effectiveness.

Unlike your database manager, R&R Report Writer lets you create sophisticated reports without having to write a single line of code. In fact, you don't have to know that much about databases to generate even complex reports. With intuitive Lotus-like menus and instant online help, you'll be creating reports soon after opening the package. Best of all, R&R uses different fonts so you can present your data with professional-quality output every time.

Join more than 100,000 others who, like PC World, say **R&R is "the undisputed reporting champ". For just $249, you, too, can start turning data into information. See your dealer today.**

Free Demo Disk!
Call today for our free demo disk. See how R&R Report Writer works with your database to create professional-quality reports in only minutes!
800-325-9035 Ext. 8213

R&R Report Writer®

Concentric Data Systems, Inc.
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CIRCLE 315 ON READER SERVICE CARD

by Emerson Andrew Torgan

New & Improved

News of Announced Products and Upgrades

Laser Link Eliminates Need for Network Cabling

NEW **Laser Communications** is now shipping three new devices that use coherent laser light to provide wireless connectivity for an unobstructed distance of up to 1 kilometer. According to the company, the LOO-36 T1/T2 Link provides T-carrier transmission of data, voice, and video. It is used to connect T1 or multiple T1s point-to-point, achieving its 1.544-megabit-per-second T1 transfer rate without cabling. Capable of handling simultaneous synchronous and asynchronous data, the unit can also offer T2 transmission via an M1-2 multiplexer interface, upgrading networking capacity to 6.312 Mbps.

The LOO-18 Ethernet Data Link, compliant with IEEE 802.3, has a throughput rate of 10 Mbps. Each unit simultaneously transmits and receives signals, and can link computers using DECnet, TCP/IP, and XNS. The LOO-19 Token Ring System, IEEE 802.5 compliant, promises Token-Ring LAN connectivity at a 4-Mbps data rate.

The LOO-18 offers laser connectivity and transmission of data for distances up to 1 kilometer without cabling.

List Price: LOO-36 T1/T2 Link, $13,750; LOO-18 Ethernet Data Link, $15,609; LOO-19 Token Ring Link, $26,649. Laser Communications Inc., 1848 Charter Ln., Suite F, P.O. Box 10066, Lancaster, PA 17605-0066; 717-394-8634.

CIRCLE 402 ON READER SERVICE CARD

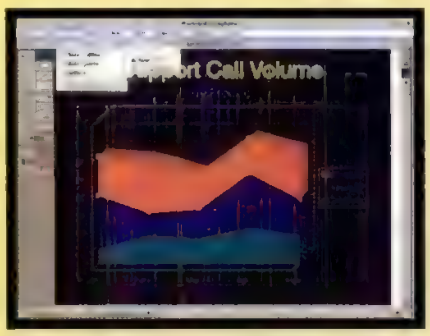
HOT PROSPECT

A HARVARD GRAPHICS FOR WINDOWS

Software Publishing Corp. has released a new Windows version of its best-selling DOS-based presentation graphics package. *Harvard Graphics for Windows* offers users a Slide Sorter, an Outliner, and a Slide Editor—three integrated modes for creating and fine-tuning a presentation.

Harvard's Chart Gallery lets users preview design and charting options by providing 88 chart and slide layouts displayed via icons. Fifty-five predesigned, customizable presentation styles include template collections offering the various charting options, a color palette, background designs, fonts, and font sizes. The templates position and format text, graphs, tables, charts, and graphics.

Harvard Graphics for Windows also lets users launch DOS and Windows applications from within the package's ScreenShow by clicking a mouse on objects onscreen. Through DDE support and the Launch Application feature, users can access and manipulate data from other applications such as databases and spreadsheets.



***Harvard Graphics for Windows* offers a rich set of presentation tools, and it will read all *Harvard Graphics* for DOS files.**

List Price: *Harvard Graphics for Windows*, Version 4.0, $595; upgrade from Version 2.3 or earlier, $125; cross-platform exchange for Version 3.0, $50. **Requires:** 8MB hard disk space, Windows 3.0 or later. Software Publishing Corp., 3165 Kifer Rd., Santa Clara, CA, 95051; 408-986-8000.

CIRCLE 401 ON READER SERVICE CARD

NET/30: Windows Front End, Compatibility for Peer-to-Peer LAN

NEW **Invisible Software** has unveiled *NET/30 for Windows*, which gives the company's DOS-based peer-to-peer network package, The Invisible Network, a Windows front end. According to the company, the package features an icon-based control panel, automatic Windows setup, an enhanced security system, e-mail, and HyperText-based on-line help. In addition to NetBIOS, the package offers TransBIOS, a communications protocol. The open-file limit has been increased to 999 files on both dedicated and nondedicated servers.

NET/30 also lets users access data from multiple workstations across a network while multitasking. It offers extended File and Print Manager functions across the network, including modification of print queues. The Control Panel utilities supplied can perform Windows File Manager functions such as connecting network drives or printers.

List Price: *NET/30 for Windows*, $399 per network site. **Requires:** *The Invisible Network*, Windows 3.0 or later. Invisible Software Inc., 1142 Chess Dr., Foster City, CA 94404; 415-570-5967.

CIRCLE 403 ON READER SERVICE CARD

Persona Adds Features To Whitewater's Actor

NEW **InnoVision Software** has released *Persona*, an add-in that supplies developers with additional editing features for The Whitewater Group's object-oriented application development package, *Actor*. *Persona* consists of a set of class libraries that add several new functions to the *Actor* Browser, including multiple windows support, an undo and redo feature, multiple method buffers, access to methods via a method list, and modification of more than one method at a time. *Persona* also provides BRIEF and Epsilon programming-editor emulators to Browser, and it works with *Actor* 3.0 or 4.0. InnoVision is looking to incorporate additional emulators in the future.

List Price: *Persona*, $129.95. **Requires:** *Actor*, Version 3.0 or later. InnoVision Software Inc., 309 Pinevue Dr., Monroeville, PA 15146; 412-392-1580.

CIRCLE 404 ON READER SERVICE CARD

BRIEFS

STATISTICS AND ANALYSIS

STSC is shipping a statistical graphics analysis package designed specifically for use with 80386- and 80486-based PCs. *Statgraphics Plus* ($1,595) offers over 250 statistical and mathematical procedures, and lets users manipulate data through presentation graphs and view the changes. *dBASE, Lotus 1-2-3, Symphony,* ASCII, and .DIF files can be imported. 800-592-0050, 301-984-5123.

Minitab's newest version of its statistical software package, *Minitab,* Release 8 ($695), has a new user interface that features pull-down menus, dialog boxes, a data editor, and a scrollable session window. Help commands appear in a scrollable window. 814-238-3280.

Kalmia is now offering a statistics package for Windows. *WinSTAT* ($395) lets users analyze data, either generated or imported from *dBASE III* and *Lotus 1-2-3* files, and save the resulting graphs and tables into reports or documents via the Windows Clipboard. A "Which Statistic?" feature helps the user determine the optimum statistical method for achieving specific results. 617-864-5567.

Pizzano & Company is shipping *Geneva Statistical Forecasting* ($495), an add-on for *Lotus 1-2-3* 3.*x* that offers line-item forecasting, unlimited batch processing of multiple number rows, linear and nonlinear regression, and single, double, and Holt-Winters exponential smoothing of spreadsheet data. 617-935-7122.

Spiral Software has upgraded its data-viewing, analysis, and plotting package. *EasyPlot,* Version 2.2 ($349), includes an enhanced batch language, new analysis tools (including weighted curve-fits and surface integrals), and new graph types (including reverse-axis plots). *EasyPlot* now supports the HP LaserJet III and color dot-matrix printers. 800-833-1511, 617-739-1511.

WINDOWS SOFTWARE

Que's *RightWriter for Windows* ($99.95) includes over 1,000 new grammar rules and a three-level help system. Sentences

CONTINUES ON PAGE 64

Upgrade Kit Turns Hand Scanners into Color Scanners

NEW **Computer Aided Technology** is now offering a combination hardware/software upgrade kit to turn your 4-inch black-and-white or gray-scale hand scanners into full-color units. A supported scanner is clipped to a lighted scanner guide (with built-in color filters) to ensure three identical passes over the image. Users scan the desired image three times—once each for the red, green, and blue components of the scan. The *CAT Color Converter* software combines the three scans into one full-color image. Scanned images are converted into .PCX or TIFF files in RGB format for use with paint programs such as *CorelDRAW, Deluxe Paint Enhanced II,* and *Paintbrush IV Plus.*

The *CAT Color Converter* can capture up to 256,000 colors when used with a supported black-and-white scanner, or up to 16 million colors with a supported gray-scale unit, according to the vendor.

List Price: *CAT Color Converter,* $169.
Requires: 640K RAM, DOS 3.1 or later, VGA display or better, supported hand scanner.
Computer Aided Technology Inc., 10132 Monroe Dr., Dallas, TX 75229; 214-350-0888.

CIRCLE 405 ON READER SERVICE CARD

Philips Unveils Multimedia, Notebook PCs

NEW **Philips Consumer Electronics Co.** has unveiled a new line of PCs under its own Philips brand label. Leading the charge is the Philips 386SX/20 MPC (Multimedia Personal Computer), complete with 4MB RAM (expandable to 8MB), 80MB hard disk, Super VGA display subsystem, sound board, and 680MB MPC-compatible CD-ROM drive. The unit is preloaded with DOS 5.0, Microsoft Windows 3.0 with Multimedia Extensions, Microsoft Multimedia Bookshelf, and Microsoft Works.

Also carrying the Philips label are the LX320, a 6.4-pound 386SX/20 notebook PC that comes with 2MB RAM and a 60MB hard disk. The LX320 that incorporates a thinner design (9 by 11 by 1.8 inches HWD), and a larger screen (9.6 inches) than previous models. The CM202XRS, the company's first internal CD-ROM drive, offers an average access time of 350 msec, according to the vendor, and comes bundled with *The New Grolier Encyclopedia* and *The PC Sig Library.*

List Price: Philips 386SX/20 MPC, $2,499; Philips LX320, $3,799; Philips CM202XRS, $549. Philips Consumer Electronics Co., One Philips Dr., P.O. Box 14810, Knoxville, TN 37914-1810; 800-722-6224, 615-475-8869.

CIRCLE 406 ON READER SERVICE CARD

Portable Hard Disk Offers Increased Laptop Storage

NEW **BSE Co.** is now shipping the Flashdrive Models 25 and 35, two external portable storage solutions for notebook, laptop, and desktop PCs. Both battery-operated Flashdrives connect to a PC via a parallel port, offer a claimed rechargeable battery life of 5 hours, and use on-the-fly compression techniques through a combination of hardware and software to double the mechanical storage capacity of the installed drive.

Flashdrives use proprietary disk controller software that occupies 15K of system RAM. They can be used with any PC that has a parallel port and is running DOS 3.0 or later, according to BSE. The units are for storage only, and cannot be used to boot a system. The Flashdrive Model 25 accepts 2.5-inch IDE hard disks from 20MB to 85MB, and it weighs approximately 1.5 pounds. The larger Model 35 accepts 3.5-inch IDE drives up to 220MB.

BSE's new Flashdrives offer portable storage and on-the-fly compression in a compact, lightweight unit.

List Price: Flashdrive Model 25: 20MB configuration, $399; 40MB, $599; 60MB, $699; 85MB, $799. Flashdrive Model 35: 20MB configuration, $399; 40MB, $499; 105MB, $699; 120MB, $799; 220MB, $999.
BSE Co., 1622 Edinger Ave., Suite F, Tustin, CA 92680; 714-258-8722.

CIRCLE 407 ON READER SERVICE CARD

QED Adds Windows Group Scheduling, Calendar Arbitration

IMPROVED In releasing *QED Office,* Version 2.0, **Strategic Marketing Associates** has added new mail and meeting notification features under Windows. Compatible with any *NetWare, PC LAN, 3Com,* or IBM network, Version 2.0 also adds group scheduling and booking. It checks the calendars of all attendees, using predefined parameters, to ar-

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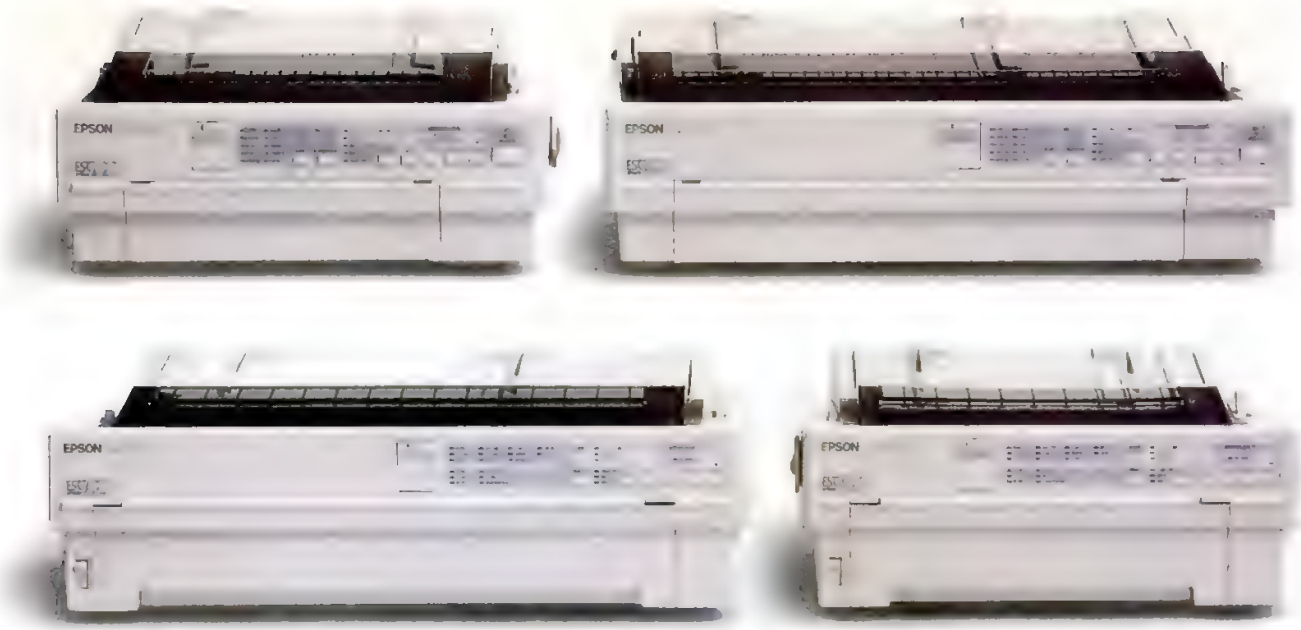
Presenting The Next Page In Printer History. From The Company That Printed The First.



Funny how history has a way of repeating itself. Year after year—actually for the past 25—Epson® has been the leader in dot matrix printing technology.

Introducing six reasons why that leadership is sure to continue: the letter-quality Epson LQ-570, LQ-870, LQ-1070, LQ-1170, ActionPrinter™ 5000 and ActionPrinter 5500.

More Paths To Success.

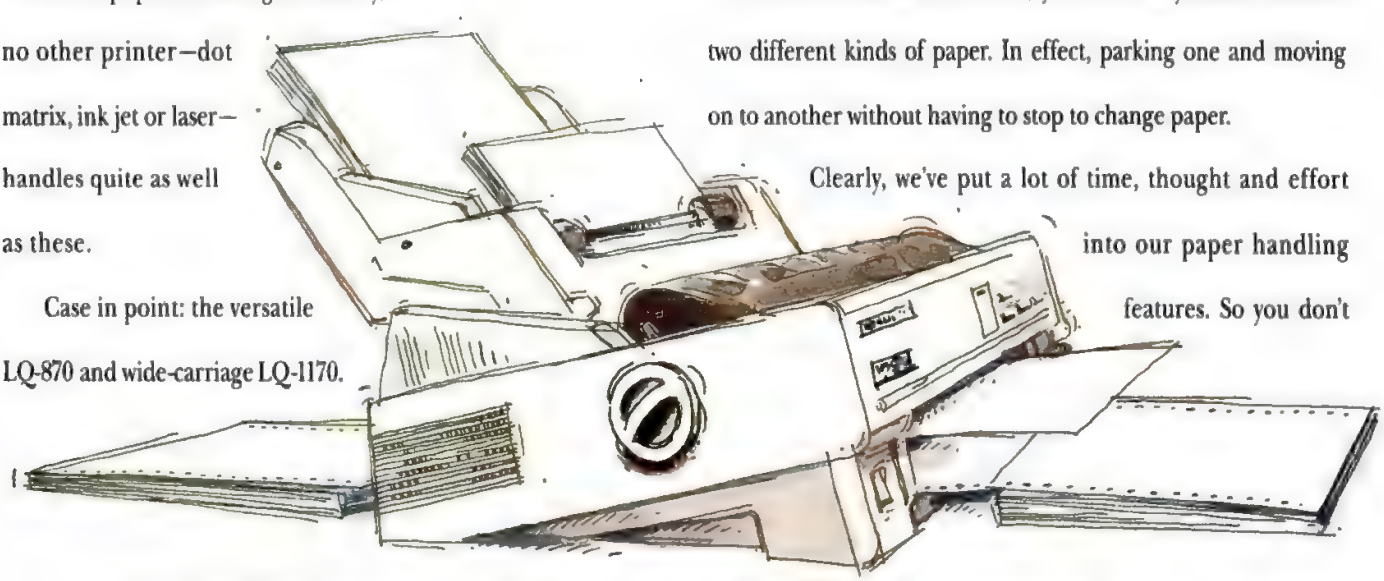
For sheer paper handling flexibility, no other printer—dot matrix, ink jet or laser—handles quite as well as these.

Case in point: the versatile LQ-870 and wide-carriage LQ-1170. When fully loaded, these printers put as many as five types of paper at your fingertips. Everything from letterhead to continuous-form checks, four-part forms, tractor-feed paper, even envelopes.

All our printers can automatically handle 50 sheets using our optional single-sheet feeder. Add our high-capacity feeder and you're quickly up to 200.

Then there's Epson SmartPark™ paper handling. At the press of a button and flick of a lever, you can easily switch between two different kinds of paper. In effect, parking one and moving on to another without having to stop to change paper.

Clearly, we've put a lot of time, thought and effort into our paper handling features. So you don't



With five different paper paths to draw from at any moment, an Epson LQ printer is as versatile as it is dependable.

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have to put much time, thought or effort into using them.

Scale New Heights.

Each new Epson printer comes with a new industry-setting standard—ESC/P2.™ This breakthrough printer control system brings scalable fonts to dot matrix printing.

Simply put, type sizes are no longer as limited. So now you can do things with a 24-pin printer that before could only be done with a laser. And you don't have to give up one bit of paper handling flexibility to do it.

Graphically Superior.

What ESC/P2 does for type, it also does for graphics. Brilliantly.

It includes an enhanced Windows™ driver, exclusive to Epson. When you print from any program running in Windows, you'll get superior output quality and faster throughput speeds.

But don't just take our word for it. Take a look at the quality of our graphics instead.

sCALABLE FONTS

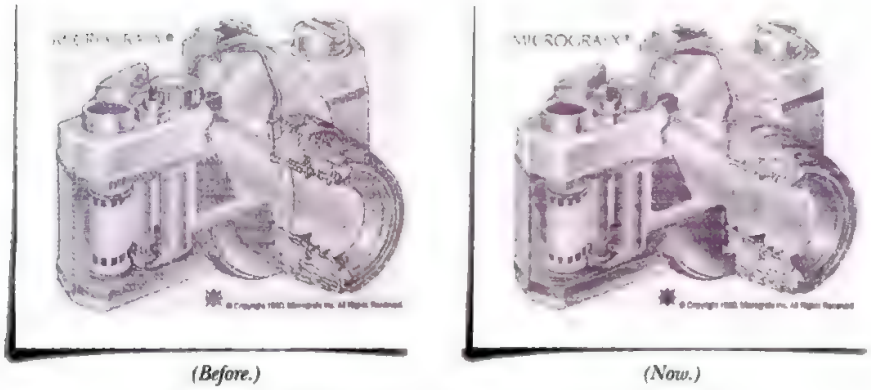
With a new Epson LQ printer, you can print a variety of type in a variety of sizes, up to 32 point.

Built For The Long Run.

Epson printers aren't only designed with more firsts, they're designed to last. Each is backed by a generous 2-year limited warranty. As well as a helpful toll-free 800 number to provide you with dependable, expert assistance.

One more thing you can always depend on: Epson reliability. It isn't a claim just any printer company can make. It's a quality—a character trait—our products have earned over time.

To see the latest printer innovations firsthand, visit your nearby Epson dealer, or call 800-289-3776. And see why, after more than 25 years, Epson is still the first name in dot matrix printing.



(Before.) *(Now.)*

Epson's enhanced Windows driver improves not only the look of your text and graphics, but the speed at which they print.

EPSON

Desktops *Dot Matrix* *Notebooks* *Lasers* *Servers*

BRIEFS

CONTINUED FROM PAGE 60

can be graphically displayed in parse trees (parts of speech), and a summary analysis of readability, sentence structure, and strength of delivery can be called up in any portion of a document. 317-573-2500.

Ibis Software's *WinFORM* ($179.95) is a forms software package for Windows with 150 predesigned business forms that can be filled and stored in ASCII file format. It can import .PCX and TIFF files as well as forms designed using desktop publishing packages such as *PageMaker* and *Ventura Publisher*. 415-546-1917.

MetaWare is shipping a 32-bit Windows application development kit. The MetaWare Windows ADK (which must be used with MetaWare's High C compiler) lets users develop, debug, and run 32-bit Windows applications ($495). 408-429-6382.

EDCO Services' *LetrTuck Professional* ($499) kerning utility runs under Windows and provides kern pair sets for 200 PostScript fonts. Each kern set includes 400 individual pairs. 800-523-8973, 813-962-7800.

IntelligenceWare is offering *WindowsTeach* ($123), which teaches Windows programming through tutorials and explanations of source code with hypertext clarifications. Resource files and structures for sample applications are displayed and explained. 213-216-6177.

WexTech has released *Doc-To-Help* ($249) for *Word for Windows* 2.0. The add-in lets users create customized documentation for the popular word processing package, and convert the new documentation into on-line help. 212-949-9595.

Armor Systems has released *Windows Interface Supervisor* ($99), a Windows interface utility to be used with its multi-module accounting package, *Armor Premier Accounting Software*. Users click on icons to bring up the various modules and can open multiple windows simultaneously. 407-629-0753.

CONTINUED FROM PAGE 60

range suitable meeting times; then it notifies participants via e-mail. Other improvements, according to the company, include an MHS communications gateway for improved message handling, a "nag" mode for mail messages, and enhanced report generation, printer setups, and macro learn mode.

QED Office also provides a contact database, calender management, e-mail, a word processor, and document and file management and retrieval, as well as reminders and to-do lists.

List Price: *QED Office,* Version 2.0: 5 nodes, $595; 20 nodes, $1,795; each additional 5 nodes, $595. **Requires:** 256K RAM; hard disk; DOS 3.1 or later; *NetWare, PC LAN, 3Com*, or any IBM-compatible network. Strategic Marketing Associates, 2785 Pacific Coast Hwy., #251, Torrance, CA 90505; 310-378-7632.

CIRCLE 408 ON READER SERVICE CARD

Da Vinci eMail Improves Storage, Adds Folders

IMPROVED **Da Vinci Systems Corp.** has improved its popular DOS-based electronic mail package with more efficient storage and ease-of-use features. *Da Vinci eMail*, Version 2.0, features a redesigned message storage system that includes the addition of personal folders for archiving mail and the ability to replace an existing message database for storage with a SQL server or other database to handle message overflow.

The new version also lets users view file attachments within the package prior to extraction, search and sort within a mailbox, and search on conversation threads. Administrators can combine user databases for improved storage or maintain private storage. When messages are deleted, *Da Vinci eMail* recovers the space for new storage.

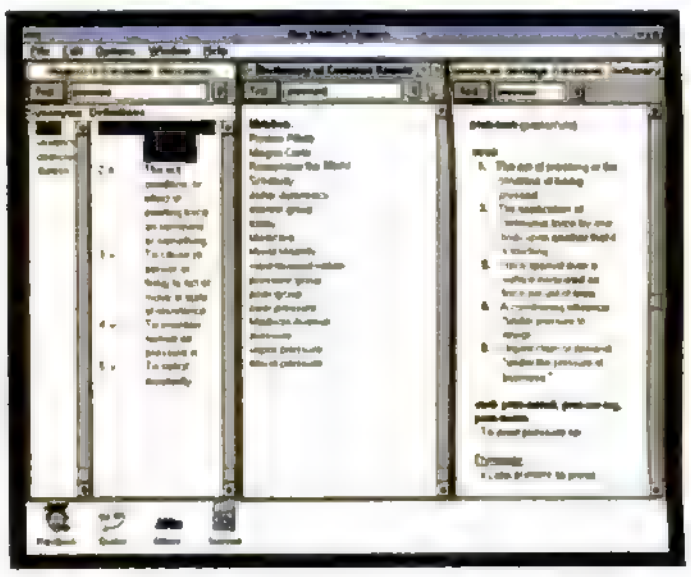
List Price: *Da Vinci eMail,* Version 2.0: 10-user starter pack, $295; each additional 5 users, $175; 30-user increase, $995; 100-user increase, $2,995; 1,000-user increase, $19,995. **Requires:** DOS 3.0 or later, *NetWare* MHS 1.1 or 1.5, any network operating system supporting shared files. Da Vinci Systems Corp., P.O. Box 17449, Raleigh, NC 27619; 800-328-4624, 919-881-4320.

CIRCLE 409 ON READER SERVICE CARD

The Writer's Toolkit Comes to Windows

IMPROVED **Systems Compatibility Corp.** has brought its DOS-based writers' tools to the Windows environment and added an encyclopedia. *The Writer's Toolkit* for Windows includes The Dictionary of Common Knowledge, based on Houghton Mifflin's Dictionary of Cultural Literacy, augmenting the DOS version's dictionary, thesaurus, book of quotations, grammar checker, book of abbreviations, and style guide.

The Windows version has a drag-and-drop feature, allowing words to be dragged from any *Writer's Toolkit* window and dropped onto icons representing the writing tools so that the user can quickly find definitions and synonyms, according to the company. A synchronization feature lets users simultaneously retrieve data from all open tools while entering the desired word or term only once. All seven tools are accessible via pull-down menus, and retrieved information can be copied to the clipboard and pasted into your current application or word processor.



Windows creates a hospitable environment for *The Writer's Toolkit.*

List Price: *The Writer's Toolkit,* Version 2.0, $129. **Requires:** 6.5MB hard disk space, Microsoft Windows 3.0. Systems Compatibility Corp., 410 N. Wabash, #600, Chicago, IL 60611; 800-333-1395, 312-329-0700.

CIRCLE 410 ON READER SERVICE CARD

Intex Unveils Four New Spreadsheet Add-Ins

NEW **Intex Solutions** is now shipping three new add-in products for *Lotus 1-2-3* and a fourth package, *CFO Spreadsheet Applications*, that can be used with *Microsoft Excel* and *Quattro Pro* as well. *CFO Spreadsheet Applications* provides 24 spreadsheet templates, available either as a complete set or in four modules of six templates each. The Cash Management module includes templates for constructing yield curves and calculating interest and cash flow forecasts. The remaining three modules are Tax Strategies, Capital Budgeting, and Advanced Topics, which includes templates for break-even analysis and calculating the debt service coverage ratio.

Forms-To-Go provides 50 forms for *Lotus 1-2-3*, such as a business credit application, purchase order, and invoice. *Compare & Contrast* compares *1-2-3* or *Symphony* spread-

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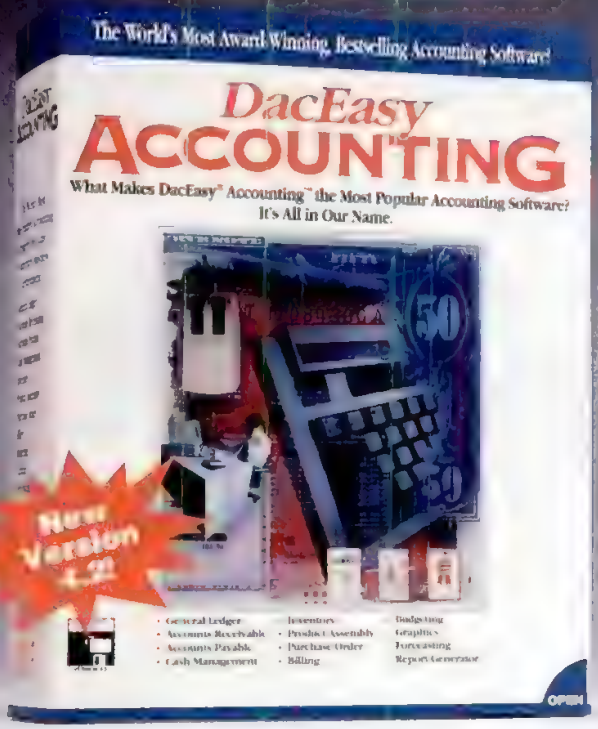
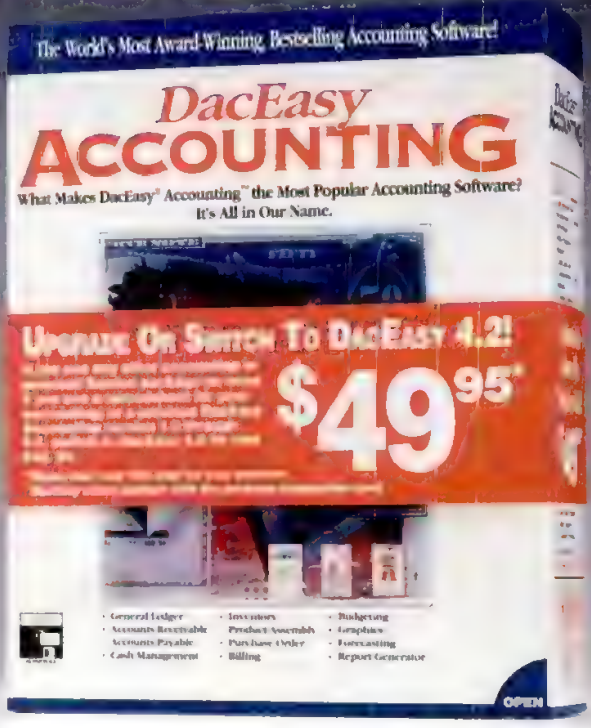
A Deal.



A Steal.



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CIRCLE 022 ON READER SERVICE CARD

BRIEFS

ANTIVIRUS SOFTWARE

Fifth Generation Systems has unveiled its antivirus software, *Untouchable*, in both stand-alone and network versions ($165 and $695, respectively). Fifth Generation proclaims that *Untouchable* can restore files infected by both known and unknown viruses, and its virus scanner does not require frequent updates with new virus signatures. The program functions as both a TSR, and an on-demand scanner. 800-873-4384, 504-291-7221.

Trend Micro Devices is shipping an antivirus software package utilizing the same virus filter found in the company's software/hardware product, PC-cillin. *PC Rx*, Version 1.0 ($69), scans for typical virus characteristics and detects boot-sector viruses when accessing floppy disks, providing a "quarantine" function. The package is network-compatible. 800-228-5651, 310-782-8190.

IMSI is shipping a new version of *VirusCure PLUS* ($99.95). Version 2.32 now detects over 890 known viruses and virus strains, and it can detect infections in compressed (.ARC and .ZIP) files. 415-454-8901.

Parsons Technology is shipping *ViruCide*, Version 2.3 ($49). The new version detects 893 known virus strains and scans compressed files such as PKLITE and LZEXE. 800-223-6925, 319-395-9626.

PRINTER ADD-ONS

Xante is now shipping Accel-a-Writer VI and Accel-a-Writer VII, two PostScript-compatible printer controllers for the HP LaserJet III and IIIP. Both utilize an AMD 29000 RISC processor, include 35 resident fonts, and use the PhoenixPage emulation language. The controllers sell for $1,295 at 300-by-300-dpi and $1,695 at 600-by-600-dpi resolution. 205-476-8189.

IQ Engineering has released Super Cartridge 3/*Creative Collection* ($399), a scalable font cartridge for the HP LaserJet III. The cartridge includes 66 typefaces and custom drivers for software packages such as *Lotus 1-2-3*, *Ventura Publisher*, and *WordPerfect*. 408-733-1161.

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sheets cell by cell to determine changes between current worksheets and saved files or previous versions. *Spellin!* is a spell-checker designed to check labels, columns, and rows in *1-2-3* and *Symphony*; it offers repeated-word check and search-and-replace functions. **List Price:** *CFO Spreadsheet Applications*, $99.95 per module; complete set, $299.95. **Requires:** 120K RAM, *Lotus 1-2-3* 2.x, any version of *Symphony*.

List Price: *Forms-To-Go*, $129.95. **Requires:** 35K RAM, *Lotus 1-2-3* 2.0 or later, *Symphony*, any WYSIWYG desktop publishing add-in such as *Allways* or *Impress*.

List Price: *Compare & Contrast*, $129.95. **Requires:** 50K RAM, *Lotus 1-2-3* 2.0 or later.

List Price: *Spellin!*, $95.95. **Requires:** 100K RAM, *Lotus 1-2-3* 2.0 or later. Intex Solutions Inc., 35 Highland Circle, Needham, MA 02194; 617-449-6222.

CIRCLE 411 ON READER SERVICE CARD

WordStar Offers Five Languages On the Fly

NEW **WordStar Writing Tools Group** has unveiled *Lexica*, Version 1.0, a multilingual translating thesaurus and dictionary available in English, German, French, Dutch, and Spanish. *Lexica*'s dictionaries contain over 300,000 entries each, and users can switch among all dictionaries on the fly. The package is a TSR occupying 16K of RAM, and it pops up over open documents for translation.

Users select words and expressions when writing in one language, and *Lexica* lists associated words and synonyms in the same language, grouped by meaning, on the left side of the screen. The right side of the screen lists translations in a second user-selected language, again grouped by meaning.

To help users choose the most appropriate translation for a word, *Lexica* provides linguistic features, such as part of speech and gender, on its translation and concept detail screens. Additional linguistic cues are given to clarify certain contexts.

List Price: *Lexica*, Version 1.0, $295. **Requires:** 640K RAM, 2MB hard disk space, DOS 2.11 or later. WordStar Writing Tools Group Inc., One Harbor Dr., #111, Sausalito, CA 94965; 800-523-3520, 415-332-8692.

CIRCLE 412 ON READER SERVICE CARD

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NEW **Unlimited Systems Corp.** is now shipping a new line of modem connection products. The Konexx Koupler Model 203 is an acoustic coupler used to connect modems to pay phones, cellular phones, and international phones that do not have an RJ-11 data jack. The Koupler attaches to the handset of any phone and plugs into your modem's line jack to provide data transmission speeds of up to 9,600 bits per second.

The same company offers the Konexx Model 108 voice/data switch, which allows users to operate two devices—such as fax and phone—on a single phone line. The Model 108 works with all modems and facsimiles, including those that draw their power from the phone line.

The Konexx Koupler provides modem connectivity at 9,600 bps over any public, cellular, or international telephone.

List Price: Konexx Koupler Model 203, $149; Konexx Model 108, $139. **Requires:** Modem. Unlimited Systems Corp. Inc., 5555 Magnatron Blvd., Suite J, San Diego, CA 92111; 619-277-3300.

CIRCLE 413 ON READER SERVICE CARD

JetFax/Windows Faxing Without Dedicated Server

NEW **JetFax** has just released *JetFax/Windows*—fax transmission software for use with the JetFax II laser printer–fax interface for HP LaserJet and compatible printers. According to the company, *JetFax/Windows* installs like a printer driver and requires no internal fax board or dedicated fax server.

The JetFax II hardware interface turns your PCL-compatible laser printer into a plain-paper fax machine. Users with access to the JetFax II can now send faxes from within Windows with all available fonts by selecting "print" from any Windows application. The standalone 7- by 2- by 18.5-inch (HWD) unit comes standard with 1MB of memory, capable of storing up to 60 fax pages, and can be upgraded to a maximum of 4MB, storing up to 240 fax pages. *JetFax/Windows* is included with the JetFax II printer ($995), and it will be available to current JetFax users for $29. ■

List Price: *JetFax/Windows*, $29; JetFax II (includes *JetFax/Windows*), $995. **Requires:** JetFax, JetFax II, Microsoft Windows 3.0. JetFax Inc., 978 Hamilton Ct., Menlo Park, CA 94025; 800-753-8329, 415-324-0600.

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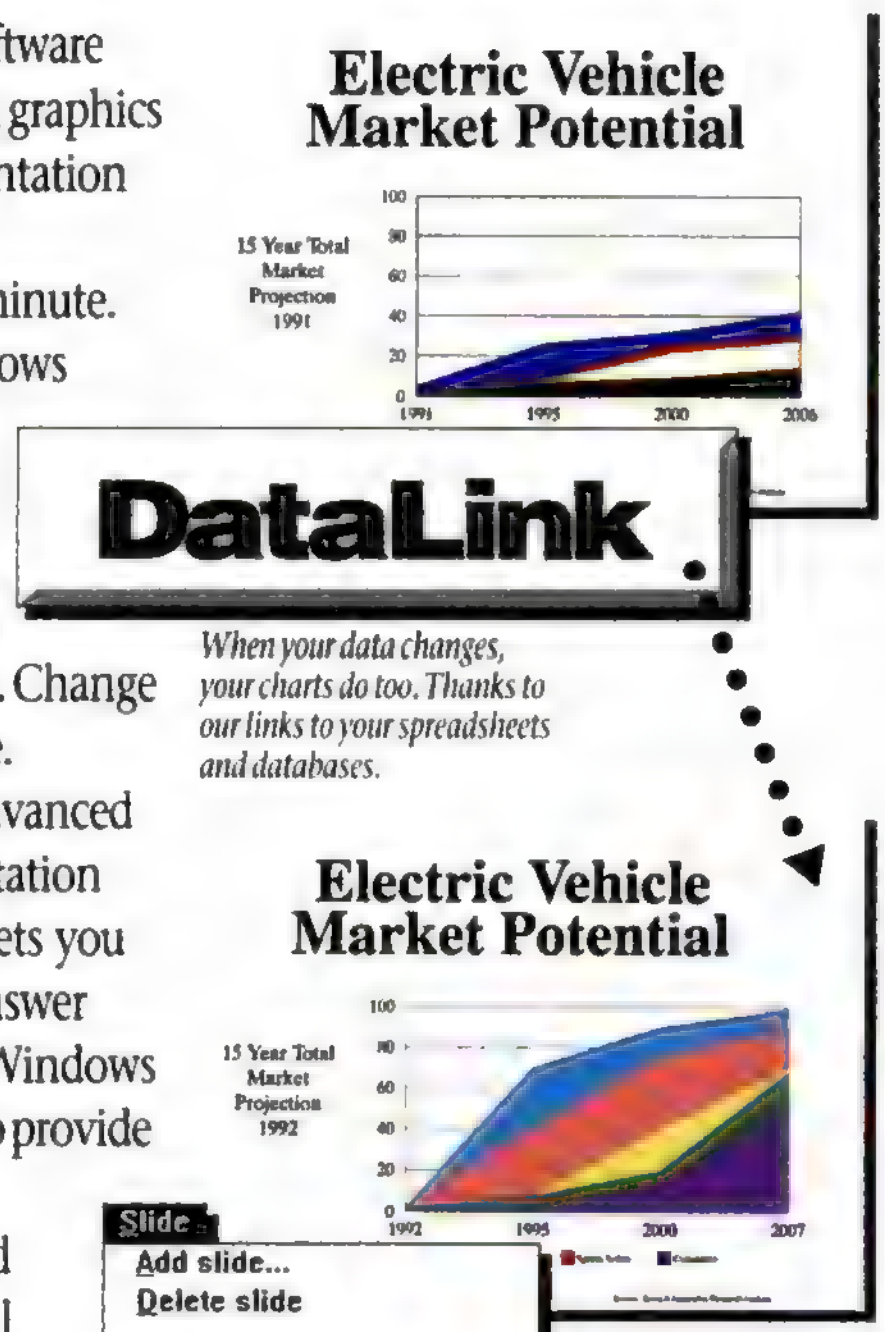

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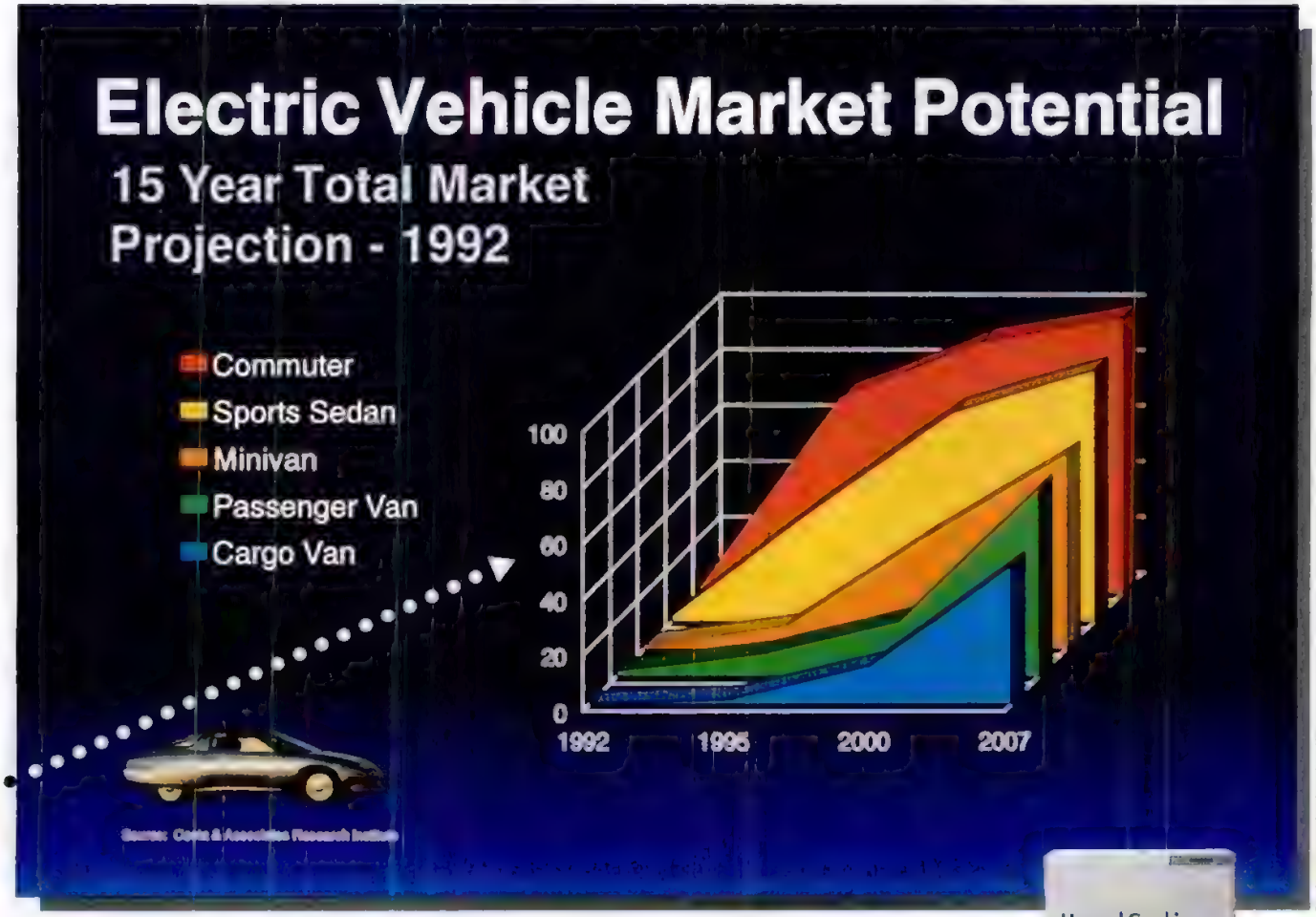

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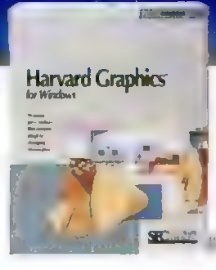

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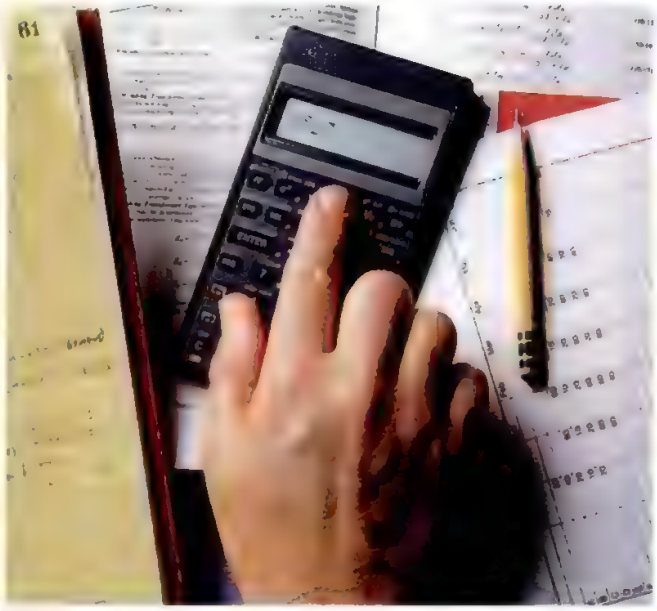

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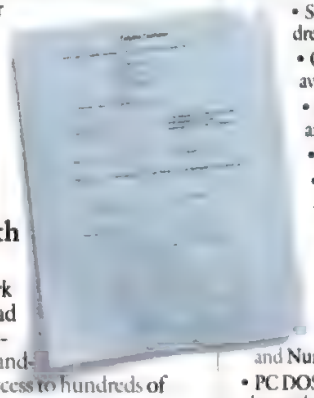

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CIRCLE 154 ON READER SERVICE CARD

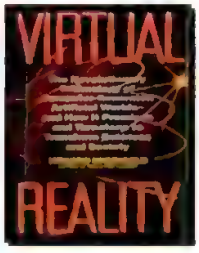
edited by Carol Levin

Read Only

Reviews of the Latest Books for the PC User

Two Reports from the Frontlines Of Virtual Reality Research

In virtual realities, the computer as tool becomes the computer as medium. These books explore current research in virtual reality, its promise, and its impact on the way we interact with computers.



Imagine entering an artificial world and exploring it like a wide-awake Alice in Wonderland. Virtual reality (VR) is such a world, a computer-based, multisensory cyberspace of 3-D visual images, stereoscopic sounds, and tactile sensations delivered through goggles and gloves. Like its subject, Howard Rheingold's *Virtual Reality* is a mind-bending adventure.

Extending his earlier quest into mind amplification tools, which he wrote about in *Tools for Thought* (1985), Rheingold is the Marco Polo of the VR realm. He spans the globe to visit VR luminaries and laboratories. He chronicles the roots of VR and fills his journal with historic notes and anecdotes about VR pioneers—J.C.R. Licklider, Douglas Engelbart, and Ivan Sutherland—and early contributions, from the World War II Link flight simulator to Hollywood's 3-D film, *Bwana Devil* (1952). His first-hand conversations with such contemporary visionaries as Fred Brooks, Myron Krueger, and Jaron Lanier make *Virtual Reality* the definitive survey of the VR terrain.

Rheingold vividly shares his VR joyrides at the University of North Carolina, where he manipulates 3-D molecules, called molecular docking. In Tsukuba, Japan, he watches himself through the eyes of a robot. At NASA/Ames Research Center in California, he enters cyberspace and manipulates a "ghostly cube of light." He shares the sensation of feeling virtual ice and molasses in MIT's Media Lab, and in Grenoble, France, he describes playing a virtual violin.

Rheingold concludes with a provocative exploration of VR in the future where anything is possible. *Virtual Reality* is an informative, insightful, and entertaining view of the brave new world of virtual reality.

Myron Krueger, a pioneer in virtual reality, blends the perspectives of engineer and artist to present an enlightening understanding of the artificial reality (AR) medium, a term he coined over 20 years ago. Unlike his virtual reality peers, Krueger creates responsive environments rather than environments that require participants to be outfitted with encumbering technology such as goggles and gloves.

In *Artificial Reality II* (an update of his earlier book, *Artificial Reality*, 1983), Krueger enthusiastically recounts the development and results of his experiments in artificial reality. The numerous illustrations and color photographs included in the book help to visualize such artificial realities as Glowflow, a computer-controlled, light-sound environment where participants inhabit a space that responds to human attention.

He also describes the Metaplay environment, which integrates visuals, sounds, and responsive techniques to allow participants to interact with an artist remotely via video and computer links. In Psychic Space, participants find their way through a virtual maze by watching a symbol on a screen. And in Videoplace, participants who are separated by distance can interact with one another using Videotouch, a simulated form of touching.

From his frontline AR experiences, Krueger shares valuable design insights. His emphasis is on aesthetics, but he lucidly covers the hardware and software aspects of AR as well. After probing the prototypes of AR technology, Krueger closes by examining future applications and ramifications of AR in our lives, from art to exercise.

—David Angell and Brent Heslop

Virtual Reality

by Howard Rheingold, $22.95, Summit Books, Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020; 201-767-5937. ISBN: 0-671-69363-8.

CIRCLE 472 ON READER SERVICE CARD

Artificial Reality II

by Myron W. Krueger, $26.95, Addison-Wesley Publishing Co., Jacob Way, Reading, MA 01867; 800-447-2226, 617-944-3700. ISBN: 0-201-52260-8.

CIRCLE 473 ON READER SERVICE CARD

Raising Interface Consciousness: Dramatic Ideas Spark Future Design

Editor of the landmark book, *The Art of Human-Computer Interface Design*, computer interface guru Brenda Laurel expounds on her own interface theory in *Computers as Theatre*. Her objective is to establish a theory of human-computer experience that extends beyond the interface community and raises the interface consciousness of software and hardware designers, students of virtual reality, and builders of interactive technologies.

Computers as Theatre is more than a polemic against mainstream interface theory. Laurel leaps beyond the conventional metaphor-based interface design and into the realm of human-computer interface as engagement. She suggests we apply "the same rigor and logic that Aristotle applied to the literary arts" in order to arrive at principles with greater acuity, robustness, and elegance.

Using Aristotle's *Poetics* as a guide, Laurel presents a dramatic model of human-computer interaction based on the six elements of structure in drama, action, character, thought, language, melody, and spectacle. Her precepts promise increased productivity by making computer interaction emotional, enlightening, and enjoyable.

Laurel's insights are bound to influence the next generation of human-computer interface design, especially in multimedia and virtual reality. *Computers as Theater* proves to be an intellectually engaging and rewarding performance.—*DA and BH*

Computers as Theatre

by Brenda Laurel, $32.25, Addison-Wesley Publishing Co., Jacob Way, Reading, MA 01867; 800-447-2226, 617-944-3700. ISBN: 0-201-51048-0.

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Microsoft Biography Tells Story of the Company, Not the Man

When Microsoft went public in March 1986, Bill Gates, its 30-year-old cofounder and chairman, was suddenly worth $390 million. A year later he was a billionaire and ranked 29th on the *Forbes* list of America's 400 wealthiest people. On the 1991 list, *Forbes* catapulted Gates from number 16 to number 2 and estimated his net worth at $4.8 billion.

The Making of Microsoft, originally written in French in 1989 by computer scientist and journalist Daniel Ichbiah and translated by Susan L. Knepper (it has been revised for 1991), traces the development of Gates's "dream child" from its very humble punch-tape beginnings as Traf-O-Data through its first days as Micro-Soft in Albuquerque, and finally home to Seattle where MS-DOS, *Word*, *Excel*, and Windows came to fruition.

Painfully long on historical detail (including things like itineraries of Microsoft executives' business trips) but painfully short on interviews and personal recollections, this account of Microsoft's rise is a rather dryly written clinical study, complete with blow-by-blow accounts of every product's design and introduction and countless excerpts from computer magazine reviews of Microsoft products.

What this book lacks is an insightful analysis of what makes Bill Gates tick, how he manages his sprawling empire, or what his competitors think of him. This is a biography of the company, definitely not of the man.

That doesn't mean that Ichbiah's account is without interest, since the story of Microsoft is in great part the story of the PC industry. The book's most informative section is Ichbiah's account of how Gates nurtured his company in the underpowered, overcomplicated, multistandard pre-IBM PC era. (Remember MITS and Osborne?) The tangled tale of how Gates got his DOS onto the IBM PC gives the book its most dramatic moments.

Someone other than Ichbiah will have to tackle the job of getting inside Bill Gates's head, but as a detailed account of the rise of a billion dollar corporation, *The Making of Microsoft* is good motivational reading for anyone with big dreams. Ichbiah points out that Gates himself "particularly enjoys reading success stories about other companies," and if you want to run a billion-dollar company, you may want to follow his lead. It would take a hundred Horatio Algers to dream up a story like this.

Ichbiah's book isn't the only one about the rise of Microsoft and the PC industry that will soon hit bookstore shelves. *Accidental Empires*, by *InfoWorld* columnist Robert X. Cringely, is a spicy and cynical history of the PC industry. Published by Addison-Wesley, it will be reviewed in this column in the March 31, 1992, issue. And industry columist Stephen Manes is preparing a biography of Bill Gates, *Billion-Dollar Bill*, which Doubleday expects to publish in November 1992.

—Don Willmott ■

The Making of Microsoft
by Daniel Ichbiah and Susan L. Knepper. $19.95. Prima Publishing, P.O. Box 1260, Rocklin, CA 95677; 800-255-8989 (ext. 504), 916-786-0465. ISBN: 1-55958-071-2.

CIRCLE 475 ON READER SERVICE CARD

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Ron White, PC Computing
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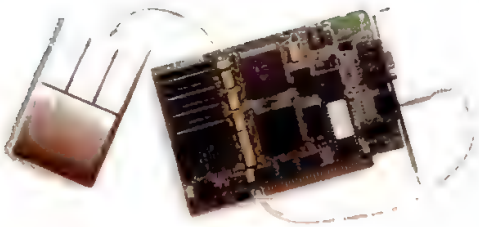

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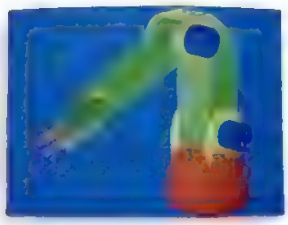

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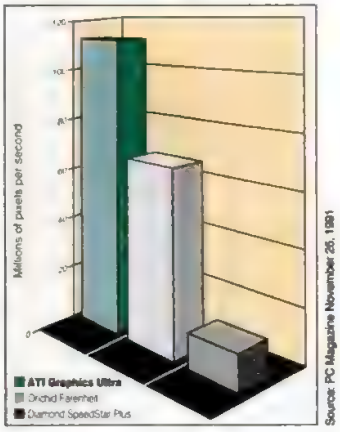

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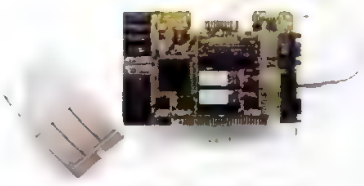

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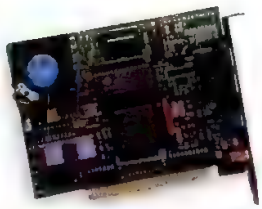

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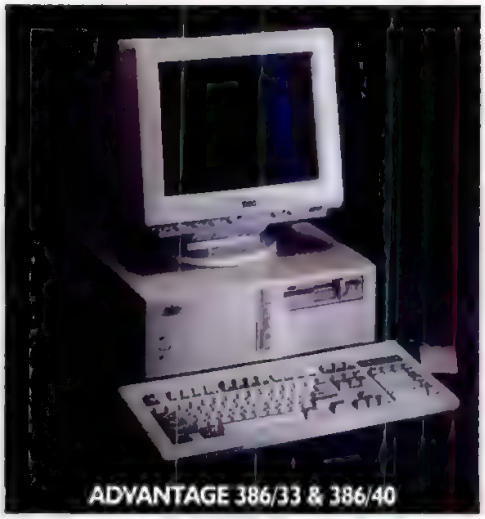

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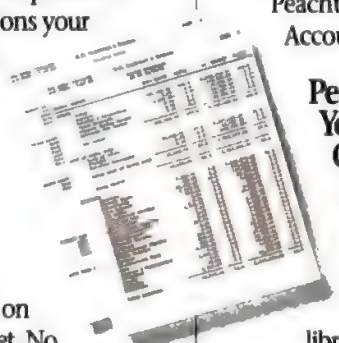

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CIRCLE 358 ON READER SERVICE CARD

edited by
Trudy Neuhaus

Toolkits

Reviews of the Latest Tools for the PC Programmer

Access the Capabilities Of over 750 Printers with SLATE

If you've ever written a program that requires high-quality printed output, you've been faced with the problem of how to support multiple printers. Every printer speaks a different language. The escape sequence that tells a laser printer to underline text is Greek to a dot matrix printer. One option is to stick to plain-vanilla output. Another is to learn the intricacies of each printer's command language; however, this can be time-consuming and expensive.

The best option, if you are a C or BASIC programmer, is to use SLATE Universal Printer Driver with Graphics, Version 2.2, from The Symmetry Group. It supports over 750 printers, including the HP LaserJet III and PostScript-compatible printers. Its 170 text-printing functions and 60 graphics-printing functions give you access to virtually all of a printer's capabilities. It supports kerning, leading, overstrike, underlining, strike-through, color printing, and font selection (including soft fonts and scalable fonts). You can also set exact print positions independent of rows and columns. Yet if you send output to a printer with lesser capabilities, the commands that are not supported are conveniently ignored.

In addition to the over 750 printers specifically supported, a default "generic" printer is provided that is configured as a lowest common denominator, usable for any printer.

While there are no royalties, all this capability does not come cheaply. SLATE with Graphics retails for $448 for a single programmer (site licenses are more), or $998 with source code. The standard libraries support Borland C compilers (Turbo C 1.5, Turbo C++, and Borland C++ 2.0) and Microsoft C 5.0 and 6.0. Libraries for Lattice C, Aztec C, Microsoft C 4.0 and Microsoft QuickBASIC 4.5 are available for an additional $25 each. For an annual fee of $149, you can receive updated libraries, tools, and printer databases two to three times per year.

SLATE'S COMPONENTS

SLATE Universal Printer Driver with Graphics has three components: SLATE, SLATELIB, and SLATEGPH. SLATE contains a master printer database and utilities for configuring a printer database that you can include with your program in one of two ways: You can use SLATE to configure a printer database that contains only those printers and capabilities that your users will need, or you can incorporate SLATE's entire printer database and tools into your program and let your users select the kind of printer and support they want.

If you choose the latter approach, you should seriously consider buying SLATEUTL. SLATEUTL is an add-on library that contains the function calls used by SLATE. You can use SLATEUTL with the interface of your choice to produce a database configuration utility that looks like the rest of your program. You could use the standard configuration utility that comes with SLATE, but its many options and technical presentation are far from user friendly. SLATEUTL is available for $149 ($349 with source code).

SLATELIB is a library of text functions, and one of its nicest features is its message system. SLATE monitors printer output as it is sent from the computer to the printer. You can take advantage of this feature and display useful information for your end users by intercepting critical errors caused by SLATE's calls to DOS. (All other critical errors generated are passed to your own critical error handler, or the default handler.) The message system can tell you when the printer is off-line or when the printer buffer is full. A default message system is provided, but if you'd like to have the messages displayed in a manner consistent with the rest of your program, you can substitute another message display routine.

SLATELIB also provides Ctrl-C, Ctrl-Break, and fatal error handling. When a break or a fatal error is encountered, a long jump to a special cleanup function takes place. However, you have to determine what cleanup is needed by SLATE and to close all the SLATE systems properly.

SLATEGPH lets you read images from a variety of sources, including video memory, .PCX, and .TIF files, and raster images in memory generated by other means (for example, Metagraphics or Genus graphics libraries). SLATEGPH also lets you scale, rotate, and print a variety of images. But because there are so many printing options (especially noninteger scaling), and because in order to work with a wide range of printers the data cannot be read in large blocks, graphics printing is quite slow. Printing a two-thirds page image from video memory on a laser printer at 150 dots per inch using a 20-MHz 386 computer takes about 3 minutes. When the computer is a 12-MHz 286, it takes nearly 15 minutes.

This graphics component, which is the newest addition to SLATE, is somewhat less intuitive to use than the text portion. For example, when video graphics printing is aborted, it is necessary to explicitly "clear" the graphics image (delete the table entry for the image and release any allocated memory). Failing to do this can cause your program to run out of memory or print out garbage. This is not immediately obvious, nor is it documented clearly.

SLATE's documentation is detailed, but does not give an overview of how the various functions work together; that is, what functions need to be called and in what order. Sample programs are provided, but they sometimes contain uncommented calls to undocumented SLATE functions in important areas such as fatal error recovery. Needless to say, this limits their instructiveness. And while The Symmetry Group provides excellent technical support, it is a toll call.

SLATE Universal Printer Driver with Graphics is a powerful and complete set of libraries and utilities. If your printing requirements are modest, the relatively high price and steep learning curve may be a reason to seek out other solutions. However, if you are writing an application that requires you to access a wide range of capabilities on many different printers, the savings in development time makes SLATE a real find.

—Sheryl Canter

***SLATE Universal Printer Driver with Graphics,* Version 2.2.**

List Price: $448 ($998 with source code). **Requires:** 128K RAM, hard disk, DOS 2.1 or later. The Symmetry Group, P.O. Box 26195, Columbus, OH 43226; 614-431-2667.

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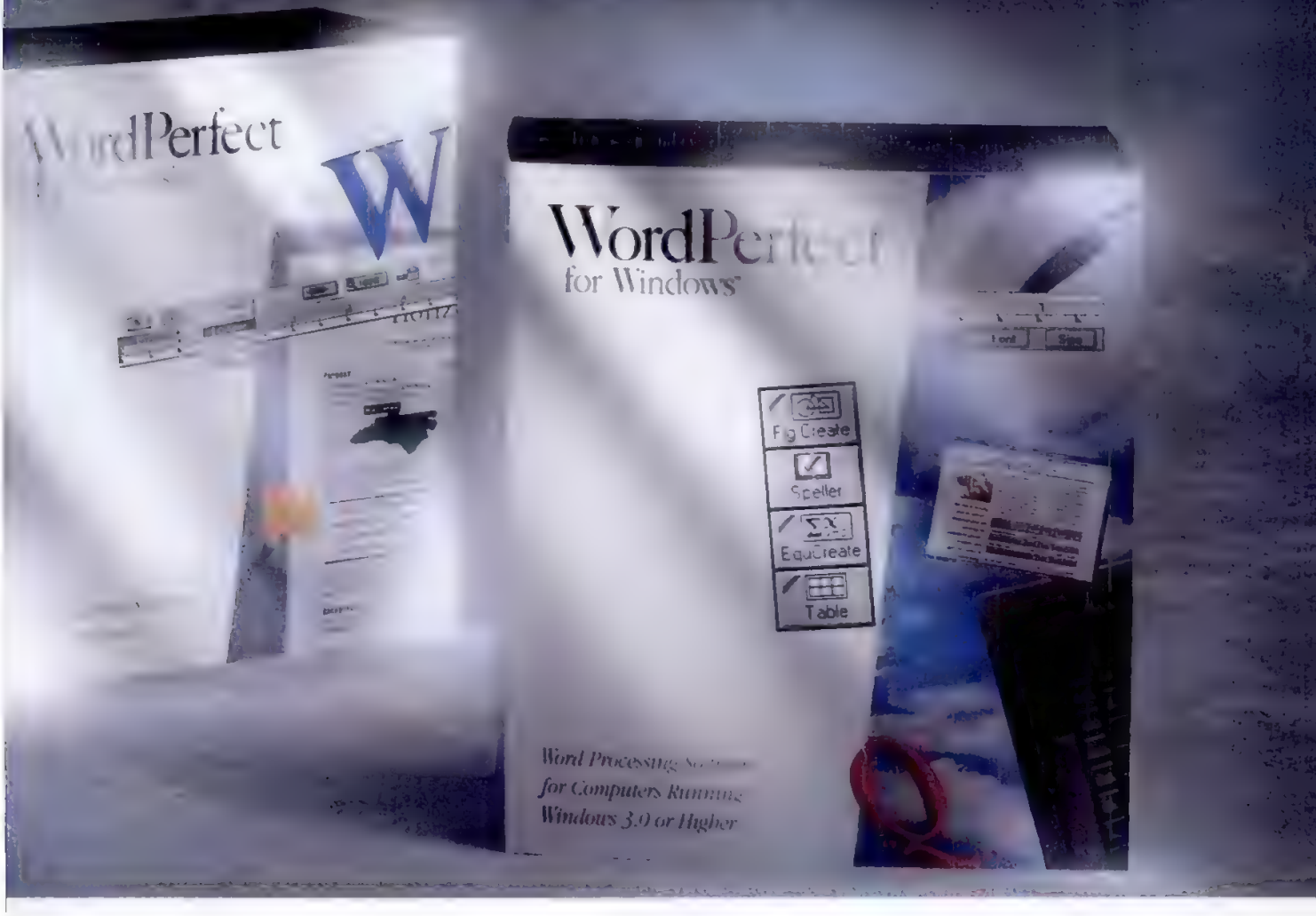

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Michael J. Miller

Of Keystrokes And the Transition To Windows

The growing acceptance of Windows means that more DOS-based programs are going graphical. But they've got some baggage to take along: DOS keystroke and file compatibility are vital.

With Windows software becoming so prevalent, it's interesting to see the different approaches that various vendors have taken in moving their DOS programs to the new environment.

Some Windows products, of course, are essentially new programs without DOS equivalents, such as Aldus's *PageMaker*, *Microsoft Excel*, and Borland's *ObjectVision*. Others share a name but little else with their DOS counterparts. That's certainly the case for most of the presentation graphics packages I've seen. *Lotus Freelance Graphics for Windows* feels like a new program and the same is true for the upcoming *Harvard Graphics for Windows*.

In other cases, compatibility with the existing DOS products is absolutely crucial to a program's acceptance in the Windows market. We've reported how *Lotus 1-2-3 for Windows* looks like a standard Windows program but brings up its "classic" menus whenever you hit the slash key. That and its macro compatibility with the DOS version are the strongest reasons for choosing *1-2-3 for Windows*.

Keystroke compatibility is particularly important in word processors because so many of us have the word processing commands almost ingrained in the tips of our fingers—one reason why so many different packages continue to be successful. As a result, you would think word processing vendors would have a tremendous incentive to make their Windows products work as much like their DOS programs as possible.

INTERFACE ABOUT FACE

In practice, only *WordPerfect*, the dominant marketshare holder of DOS word processing, has taken this route. When *Microsoft Word for Windows* first came out, it was markedly different from Microsoft's DOS version. Microsoft took the rather unusual step of changing the interface of its newest DOS product, *Word* 5.5, to be more like the Windows version and less like the *Word* 5.0 version. Similarly, *Lotus Ami Pro* is a totally new product. Although *Ami Pro* was developed by the people who created the character-based *Samna Word*, they didn't try to make it compatible.

WordStar for Windows takes the middle ground. You can run it with Windows keystrokes or the traditional character-based Ctrl-key combinations. But the transition isn't perfect. Yes, you can use the classic *WordStar* cursor diamond to move through text, but other things are missing, notably the way you mark blocks and the dot commands that gave you most of your format control.

More important is that the *WordStar* Windows and DOS versions simply feel very different. When *WordStar* came out, one of the things that distinguished it from its early competitors was that it could do formatting and editing at the same time. *WordStar for Windows* misses the mark here. You still can do basic editing and formatting in the Page Editor view, but you can't change the overall layout or move a frame unless you switch to a separate frames mode—a tremendous disadvantage. If you want a product that feels like the DOS version, it's your best choice, but it still requires a fair amount of retraining.

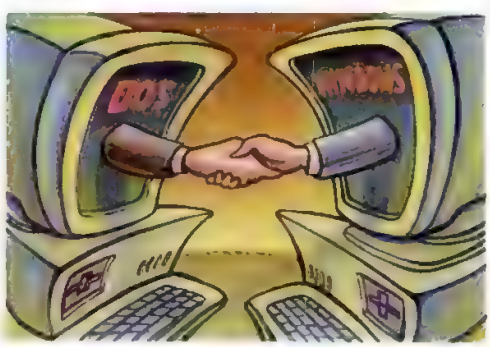

ILLUSTRATION: PETER FASOLINO

WordPerfect for Windows is a different case. This is a product that feels a lot like the character-based version so many people are used to. As in the DOS version, you can choose your keyboard for the program. Your standard choices include a default keyboard (which *WordPerfect* calls CUA and that follows the traditional Windows conventions) or a *WordPerfect* 5.1–compatible keyboard. The later

keyboard isn't perfectly *WordPerfect* compatible: You can't enter numbers for your choices after the first-level menus, and F1 gives you help instead of the *WordPerfect* standard F3.

Still, the product feels like the DOS version in most ways. It maintains the reveal codes window that shows you the codes in your document, and you can set your defaults so this works much like the DOS product. You can use your old *WordPerfect* printer drivers and fonts instead of the Windows drivers. *WordPerfect for Windows* uses the same file format as the DOS version, so there's no need to translate documents between different file formats as you must with every other word processor. There's even a useful transition guide that points out the differences between the Windows and character-based versions.

In short, it's a very good compromise; even if you choose the CUA keyboard, it still feels like *WordPerfect*. One minor problem: It doesn't support macros from the character-based version, so you'll have to convert all your macros. It also lacks some of the bells and whistles of the other Windows word processors, but if you use *WordPerfect*, you're likely to feel at home.

With *Word for Windows* 2.0, Microsoft has also set its sights on DOS *WordPerfect* users by putting in a "*WordPerfect* Help" feature that can either teach you the *Word* keystrokes or run the program from *WordPerfect* keystrokes. In some ways, it's more keystroke compatible than *WordPerfect for Windows*—the menus are a bit deeper. Still, the program feels significantly different from *WordPerfect* 5.1. It just has a much different (but equally as good) way of working with stylesheets, graphics, and layout options.

In short, we have seen some very different approaches to bringing compatibility between character-based and Windows-based word processors. It's unclear which is the best approach, but these efforts certainly will encourage people to move to a graphics-based word-processing environment sooner.

Moving to Windows is a transitory thing; you do it and then, in the long run, you forget about it. But there's also a need to make DOS and Windows work together at the organizational level. Perhaps the most important component will be continued (and even improved) file compatibility. While many users will rush to take advantage of the on-screen fonts, multitasking and advanced formatting capabilities of the new generation of Windows word processors, other users, who need only the basic character-editing features, will likely stick with their existing DOS-based word processors.

Also, under Windows, it becomes easier to move information between applications. Windows users will grow accustomed to using more new programs, since all the programs have at least certain basic elements in common. I expect that these factors will result in organizations that use a number of different word processors, rather than a single standard. For these reasons, we need not only to make it easy to move from DOS to Windows, but to make it easy for users of both environments to work together. ■

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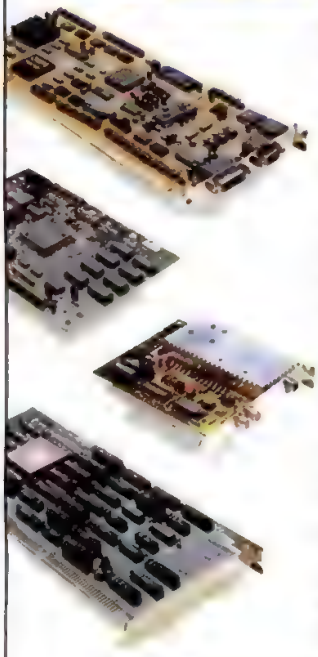

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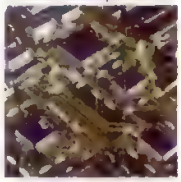

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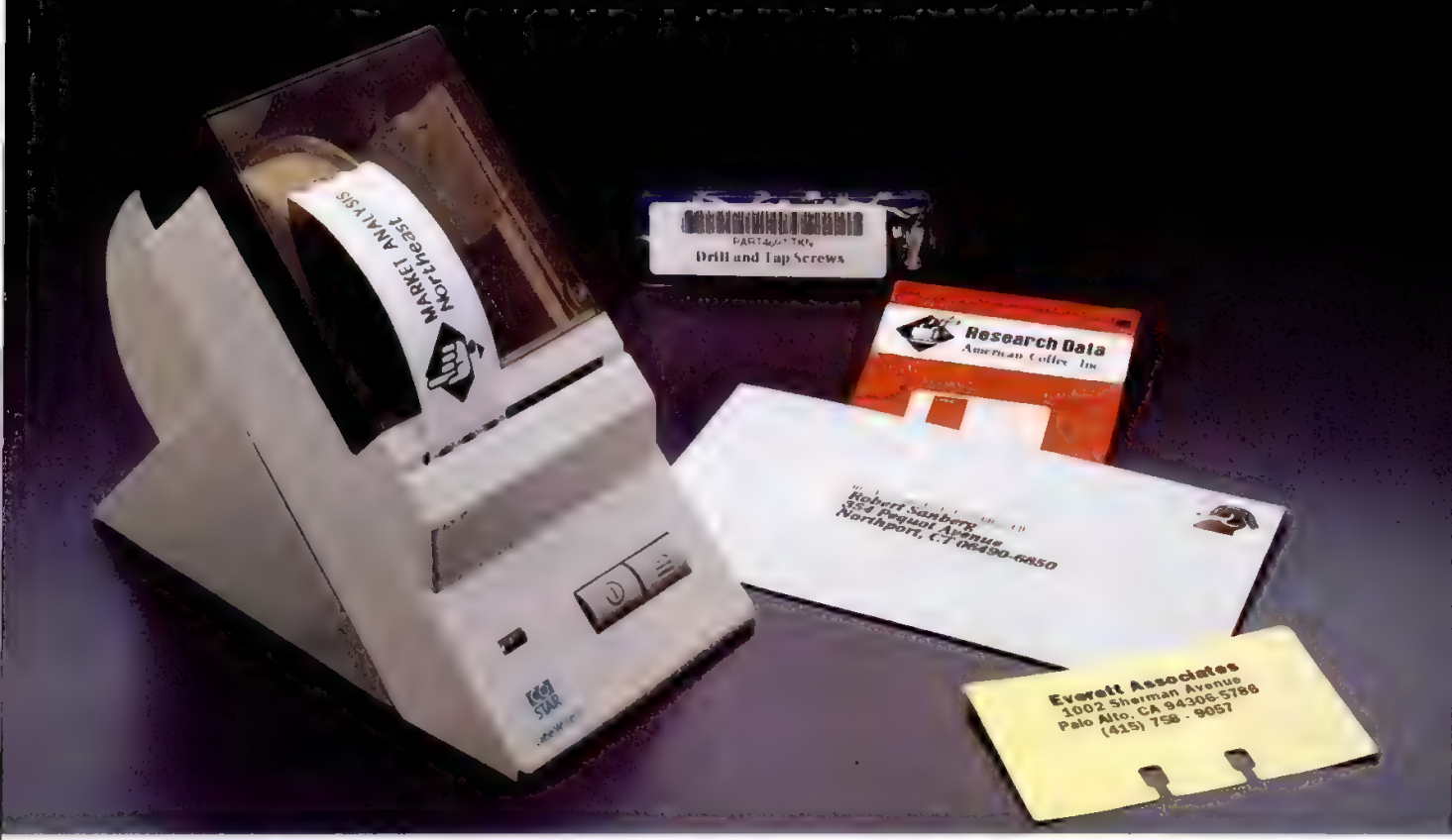

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Bill Machrone

PS/1: You Can Go Home Again

IBM's PS/1 has been revamped and expanded, and gets a warm welcome at the Machrone house.

You may recall that the original IBM PS/1 was a somewhat underpowered 286 with nonstandard expansion, insufficient memory, a noisy hard disk, and too high a price. Flaws notwithstanding, it was a big hit in our house. My six-year-old, Andrew (who was five at the time) put it together. My daughter Stephanie used it as her Prodigy machine, and seldom did a day go by that it wasn't in use. It lived in the den on one of those kid-sized oak tables, and it looked just right.

When the new PS/1 showed up, the kids didn't clamor to put it together. After all, computers are old hat around here. But when I told them that it had a CD-ROM player, it piqued their interest. So last Friday night was computer night. I pulled all of the various parts and pieces out of the boxes and set them on the kitchen table. Stephanie was the official documentation reader, and the kids were to take turns attaching things.

The first problem we ran into was that documentation is linear and ten-year-olds aren't. The second problem was that Andrew, resplendent in his victory over the last PS/1, was overconfident in his ability to assemble this one. The CD-ROM drive is in a separate case, which attaches to the bottom of the PS/1 case. A springy metal knockout had to be removed in order to let the CD data and audio cables pass through the bottom of the PS/1 case. This roadblock was enough to defeat Andrew's solo attempt. A little adult intervention solved the problem. Apart from the CD-ROM installation, the rest of the job was thankfully uneventful. It took only half an hour from packing case to power-on.

AESTHETIC JUDGMENT DAY

I moved the new PS/1 to its place of honor on the oak table. But the system unit on the new machine is twice as high as the old one. Add the CD-ROM, and the permanently tilted monitor gazes ceilingward somewhere above a child's head. I flipped down the monitor's back foot, which kicked up its tail at a rakish angle—making the surface of the screen vertical.

We flipped it on. It booted into the familiar icon-based menu system. "That's a cute set," my mom said. "Nice picture." Grandma doesn't differentiate heavily between TV, Nintendo, and computers. Stephanie surveyed the new installation: "I hate to say this, Dad, but it's ugly." I trust the aesthetics of a child who took down her New Kids on the Block poster to put up a 6-foot-long photo of an IROC Z-28 Camaro.

The new case must have been designed by the guy who put all those portholes on old Buicks. It's festooned with squarish vents, the better to exhaust the heat from two 16-bit ISA expansion slots and from the CD drive. The tiny axial fan from the original case is evidently not up to the job. Andrew sat down in front of the new machine, looked dubiously at the thin plastic leg that tilted the monitor face toward him, and said, "I feel like it's going to fall on me."

I moved the monitor to the side of the system unit and flipped the leg back up. Access to the CD-ROM is now much easier, but the unit didn't get any prettier with my redecorating. Andrew's comfort level was appreciably higher, though. I asked my mother what she thought of the looks of the new machine. "Very nice. But why does it always have the same program?"

ILLUSTRATION PETER I ASCUNO

The new 386SX PS/1 has 2 megs of RAM on the motherboard, and another 2 megs in a dedicated expansion slot. I never thought I'd live to see the day when a PS/1 would be able to count up to 4096K. Also, the 81MB Maxtor hard disk is far quieter than the drive in the 286. The display is the same old fuzzy 12

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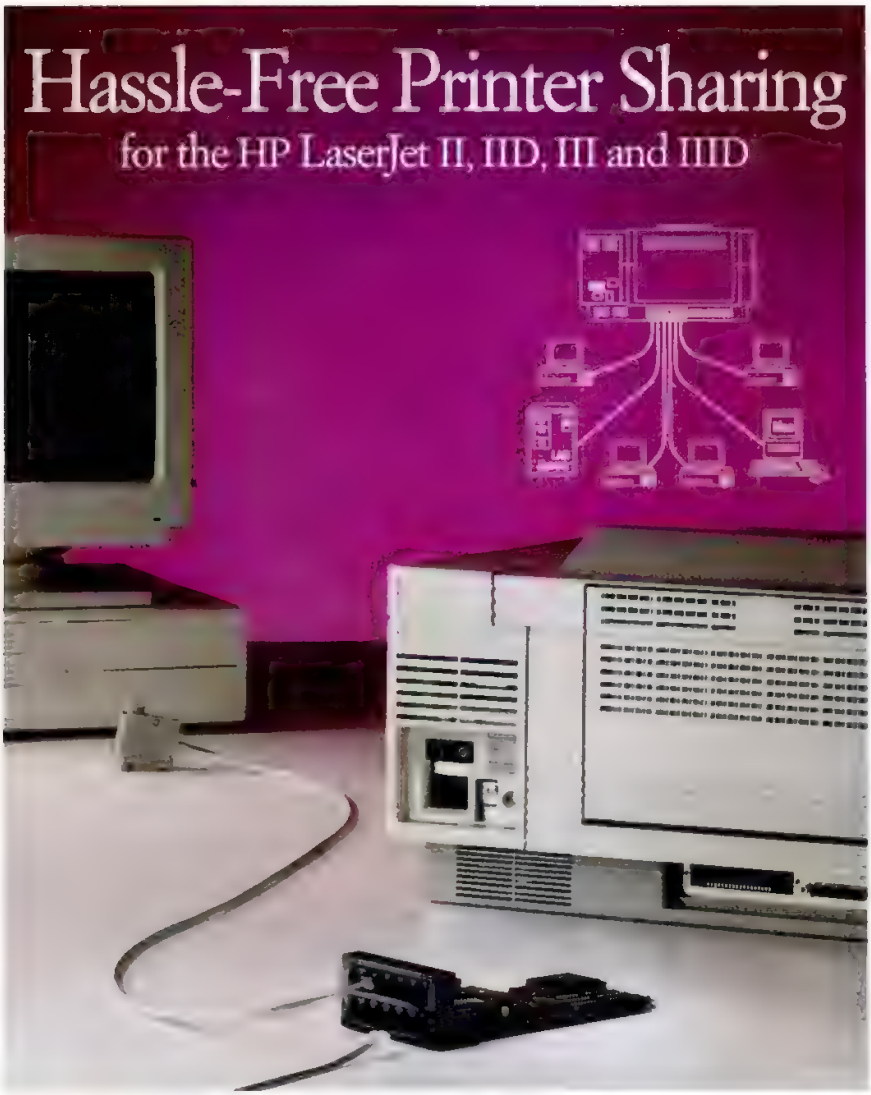

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Bill Machrone

incher. It seemed tolerable until I stuck a laser-sharp NEC MultiSync 4FG on our desktop machine. If IBM is serious about the ultimate success of the PS/1, it has to improve the display quality.

IS IBM SERIOUS?

I've seen the new ads where they're pitching the PS/1 as a small business machine. Now that it has a 16-MHz 386SX chip, enough RAM, and a decent hard disk, it's in the ballpark. Retailers are offering the machine for $1,300, a far cry from the $2,000 list price of the original PS/1. It also bundles Windows, which shows that in this case one hand doesn't care what the other is doing. Until now, IBM was wildly overprotective of its product lines, and positioned them as far apart as possible. Apparently, the gloves are off at IBM, and whichever division can sell a machine is welcome to whatever buyers it can attract. It's about time.

The new PS/1 also gives IBM a toehold position in the multimedia market, in case the PS/2-based Ultimedia line doesn't light buyers' fires. The PS/1 isn't MPC (Multimedia PC) compatible, but it would take only a Sound Blaster or some other sound board to make it so. Many multimedia disks work just fine on the PS/1, using its built-in three-voice sound chip and internal speaker.

One company that is serious about the PS/1 is Tecmar. Long an early supporter of new architectures and challenging technological problems, Tecmar offers a PS/1 video option.

From the grassy plains of Solon, Ohio, comes Tecmar's Vision/1, a $395 video adapter for multimedia applications.

The Vision/1 gives you full-screen or picture-within-a-picture video, complete with a cable-ready tuner. I ran a variety of signal sources through the Vision/1, including antenna, cable television, and VCR. The kids quickly figured out that they could run Nintendo through it and play two games at once! Tecmar includes software that puts a fully controllable video window into Windows. There's no computer control of the VCR, but most low-end applications don't need it.

So suddenly the IBM PS/1 has become a desirable machine for anyone's home. And Grandma can even watch "Donahue" on it. ■

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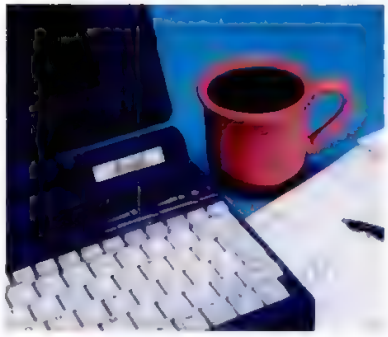

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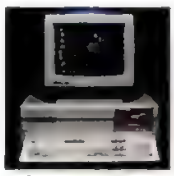

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NOTES: Customer satisfaction results were compiled from PC Week's survey of PC managers whose organizations have purchased mail-order PCs. 15 customers of each vendor were surveyed.

Prices and specifications shown were supplied by vendors, each of which was asked for a quote on its lowest-priced 25Mhz 386 machine with 4M bytes of RAM, dual floppies, a 100M-byte hard drive, 14-inch Super VGA monitor, keyboard, mouse, Windows and DOS 5.0. Any changes to the configuration or no-cost options are shown. Prices were gathered by calls to each vendor between Oct. 3 and Oct 14, and include tax and shipping charges.

*System is upgradable.

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John C. Dvorak

The Perfect Notebook Computer

Mousetraps are easy. How about building the perfect 3-pound portable?

The quest for the perfect notebook computer is never-ending. The latest notebook from NEC, the UltraLite III, hints to the future. It's the same hint given by the original UltraLite.

The UltraLite III is a 386SX notebook weighing in at just under 5 pounds. It contains no internal floppy disk drive, which seems to be the controlling factor in any effort by manufacturers to keep notebooks under 5 pounds (my personal limit on weight). There has not been a machine made with both a hard disk and a built-in floppy disk drive that has weighed less than 5 pounds. Most of these floppy-filled notebooks weigh 7 pounds.

I harp on this weight issue more than other writers. Others say it doesn't matter so much because when you're on the road, it's great to have *anything*. Well, *anything* gets old fast when you have to lug it around in its own dedicated case that counts as a separate piece of luggage on airplanes.

I like to travel with one of those small Samsonite supercases with the handle and wheels. You can hook another bag or two to the strap in the handle—in my case, a garment bag. I throw the laptop into the Samsonite with my socks. I can get on and off the plane and zoom through an airport at high speeds rolling this lash-up.

A side benefit to this scheme is that I rarely get asked to open my bag to boot up the laptop at the airport security gate. Lately, I've noticed that anyone who shows up carrying a laptop in its own case will be asked to prove it works by airport security. You're just asking to be stopped. When a laptop is neatly packed inside a larger suitcase, it's more often passed over by security.

Anyway, having said all this, we still have a way to go to produce the ultimate laptop. Here are my specifications for two models.

A "power" notebook will have a 60MB to 100MB 2.5-inch hard disk. My "superlight" notebook will not have a hard disk, but will contain a PCMCIA slot to hold a credit card–sized 8MB or 16MB memory storage module. Both machines will have at least one of these slots open for installing software. The only 3.5-inch floppy disk drive available will be sold as an external option.

I've recently come to the conclusion that if you sacrifice the floppy disk drive for the weight savings, you'll do just fine once you learn to use *LapLink*, *Trans*, or *Brooklyn Bridge* to move files to and from your desktop PC. In fact, when you are on the road there's very little reason to have a floppy disk drive. After all, you can always back up files by sending them to MCI Mail or CompuServe and store them remotely.

Both of these machines will have paper-white backlit LCDs like the one Apple uses on its 170 Powerbook, and the display will be VGA. Both will contain a V.42bis/V.32bis 14.4-kilobit-per-second modem with a cellular option. The ports will use the standard DB-9 and DB-25 connectors found in AT-class machines. While a VGA output connector isn't a necessity, it should at least be an option.

Both machines will be made from some incredibly strong, lightweight, hi-tech carbon filament bonded epoxies. They will have the dimensions of a real notebook, roughly 8 by 11 inches with a thickness of 1/2 to 3/4 inches. The power machine with the hard disk will weigh 3.5 pounds, the lightweight unit will be 3 pounds.

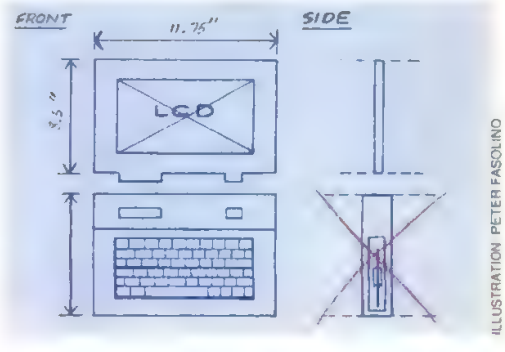

ILLUSTRATION PETER FASOLINO

With a machine like this, complete with a legitimate keyboard, you would not think twice about packing it with you wherever you go. As for the heavy 6- to 9-pound machines, these so-called notebooks won't go away. They'll live on as large capacity color machines. They'll also probably have that annoying built-in floppy disk drive.

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John C.
Dvorak

Inside Track

Will OS/2 ever **run Windows better than Windows?** Unlikely, say the experts, for two reasons. The translation of Windows functions to OS/2 functions alone will create too much overhead to outperform bare Windows. To complicate things there is **a rumor that concludes** that Microsoft has some patented or specific algorithm that requires IBM to seek a license. Microsoft is not agreeable to the cross license.

Even if IBM got help from Microsoft, IBM's inability to efficiently code software for small machines is legendary. The most remarkable example of this is the overhyped *OfficeVision* project, which involved an estimated **20,000 people** in the **programming** in one way or another. When I first heard this figure I thought it was **ludicrous,** but the nation's top IBM watchers assure me that it's indeed true. The result—a program that requires an **incredible 16 megabytes** of main memory to run. Needless to say, this has not been the hot program that IBM had been hoping for.

On the other front, IBM can't seem to buy code, either. Recently, the **worst kept secret** was that IBM was going to turn the *XyWrite* word processing software into its *Signature* word processing software. Everyone was gah-gah over this thing. *XyWrite* is an outstanding program, and it would have been perfect for IBM to turn into a competitor to *WordPerfect*. Instead, IBM **canceled the project** weeks before it was to be announced. Why?

The conclusion one must draw is that IBM just can't write effective code. When it has good code from elsewhere it dumps it. Do you wonder why Microsoft is **teasing and chiding and openly criticizing** IBM without fear? Because unless something drastic changes at IBM, OS/2 will never realize its potential and will never run Windows better than Windows or DOS better than DOS. Personally, I wish they could do it. But there is no shred of evidence that they can.

Consolidation and Gossip Dept.: This is one of those rumors I hope doesn't happen just as this issue goes to press. The chatterboxes out there are **abuzz** about a **Borland-Novell merger.** With distributed databases being an important aspect of networks and with Borland now owning both sides of the database coin (*Paradox* and *dBASE IV*), this would make for **an interesting marriage.** With the object-oriented language programmers from Borland teaming up with the operating systems people from DRI (owned by Novell, as you recall), the potential to blow Microsoft out of the water seems real.

Where does this leave Lotus? Lotus is eventually going to have to make a move to join forces with somebody, but who? What company would make a perfect match for Lotus and create an entity that could compete with a massive company such as Novell-DRI-Borland, Microsoft, or Computer Associates? **The perfect mate** is Symantec Corp. Symantec has already **beefed** itself up by buying Norton, so it now dominates the **lucrative** utilities business. It has databases, languages, and word processing. All it needs is a spreadsheet and Lotus has that. Lotus also has programs like *Magellan*, its hard disk indexing utility, which would be much better marketed by the Symantec people. If these deals happened we'd suddenly have the Ford, Chrysler, General Motors, and Honda equivalent for the software market. That would leave WordPerfect Corp. as the Packard Motor Car Company. (Hmmm, then there must be a Hudson and Kaiser someplace, too.)

Lotus is eventually going to have to make a move to join forces with somebody, but who? The perfect mate is Symantec.

Cheap Fix for Expensive Problems Dept.: One of my friend's IBM PS/2s **dropped dead.** Being a typical hapless user, he priced a fix from an authorized IBM shop and they told him he needed a new motherboard. It turned out that a new motherboard for the PS/2 80 (a 16-MHz 386) would have cost $2,600. A used one would be $1,450. Instead he contacted **Solutronix,** 7255 Flying Cloud Dr., Eden Prairie, MN 55344; 800-875-2580. Here's what he writes: "John, my repair, including shipping, only cost $295. They specialize in PS/2 and Compaq motherboards. Repair rates are flat fees and vary according to model. My PS/2 (16-MHz) cost $280 to fix. According to the head of the technical department, they replaced the video driver chip, which was kaput, along with several 'likely to fail' chips that had not yet failed." In other words, preventative maintenance.

"Why?" I asked.

"Well, it turns out that Solutronix warranties any repair for six months even if it is not related to the original fault. So, by doing preventive repairs, they drastically reduce the number of warranty repairs down the line. And make their customers, like me, much happier. It's wonderful to see an American company so obviously concerned about quality. Check them out."

Hey, Craftsmanship and Quality Is Alive in New England Too, Dept.: Don't settle for a shoddy plastic or cheap-o wood CD rack in which to store your CD-ROMs. Pay a few extra dollars and get a **stunning handcrafted dovetailed CD-ROM storage rack** from New Wing Designs in Ashby, Mass. (508-386-2495). Made from native hardwood, the company's "original" rack is designed to hold 25 CD-ROMs packed in either the jewel-box or in the CD-Caddy. For $49 plus shipping, this is a **ritzy-looking** holder worth every penny. Highly recommended and very cool. ■

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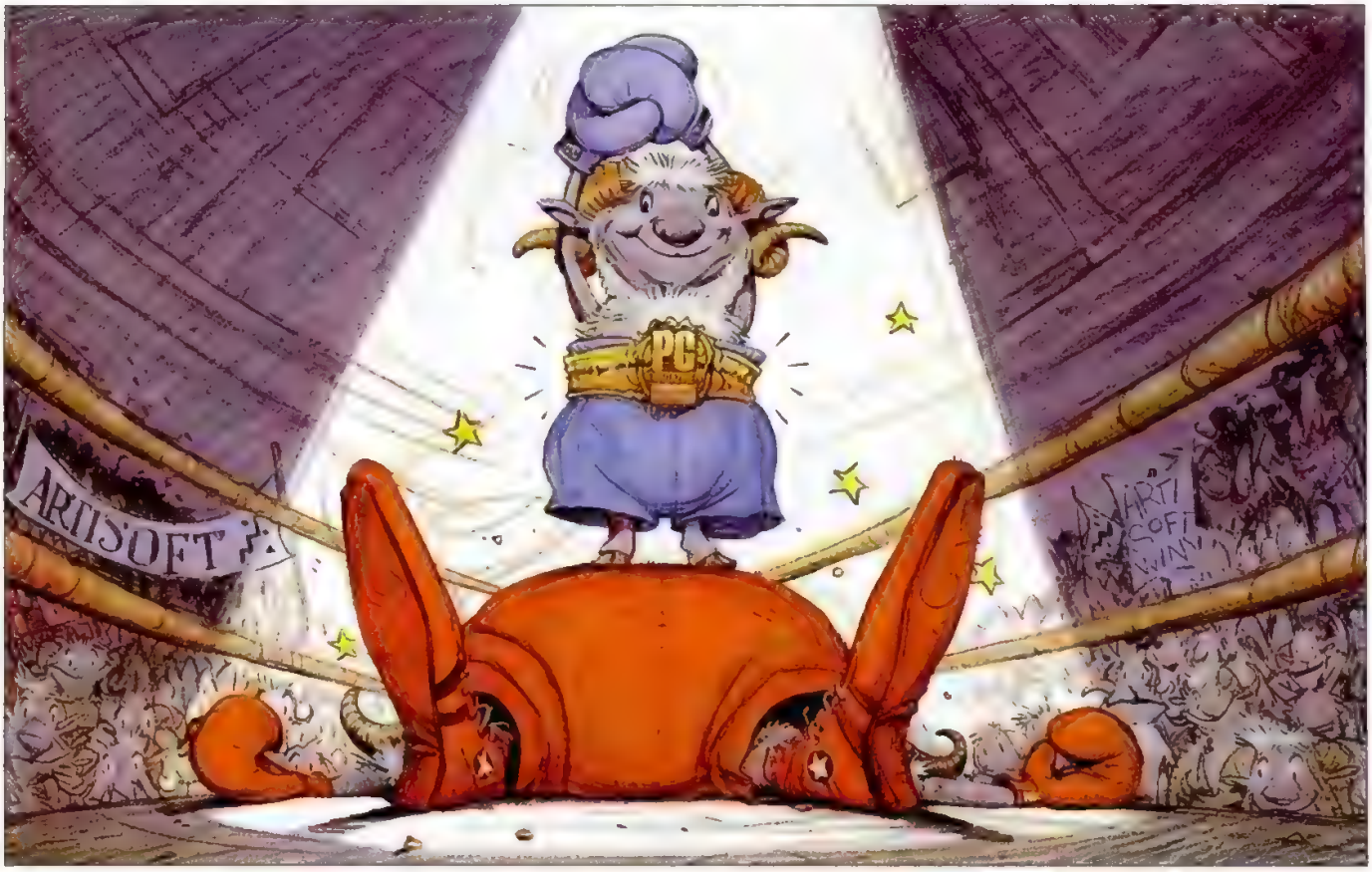

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Jim Seymour

7-Pound "Notebooks"?

Getting rid of internal floppy disk drives is the first step toward building a better notebook PC.

It was getting out of hand there for a while. But it looks as if things are getting back to normal.

I'm talking about the size and, more important, the weight of so-called "notebook" PCs. The first machines were really light and small, but then for a while it seemed as if vendors had forgotten the definition of notebooks. Now, new models seem to be swinging back to the true notebook PC form factor.

NEC created the category three years ago with the brilliantly conceived and abysmally marketed UltraLite. Small, thin, and roughly 4 and a half pounds, it had the right heft for a carry-it-almost-everywhere machine.

Using the UltraLite taught us a few things about what we need in notebook-size PCs. You've got to have a built-in printer port; a CGA display isn't good enough; and as great as battery-backed RAM in lieu of a hard disk sounds, you'll go crazy trying to keep those batteries charged so you don't lose all your data. The UltraLite failed those tests. . .and yet it was a brilliant machine that seemed to forecast the future of portable PCs.

When other vendors picked up the idea of notebook PCs, they fumbled. Instead of matching or reducing the UltraLite's 8- by 11.75- by 1.5-inch size and 4.5-pound weight, they produced thicker machines that tip the scales at around 7 pounds. That doesn't sound much larger or heavier when you read those numbers on paper, but when you start carrying the machines around, the difference is dramatic.

One of the villains is the internal 3.5-inch floppy disk drive. It forces the notebook to be a thicker machine and adds about three-quarters of a pound, far less than the 3-pound bloat we see in most current notebooks.

Debate has raged ever since the introduction of the floppyless UltraLite about whether notebook PC users really need a built-in floppy disk drive or not. My experience has persuaded me that we do not.

Floppy disk drives are arguably necessary for loading programs onto a notebook's internal hard disk, and for getting data out of the machine and onto your desktop's hard disk, or at least onto a floppy disk you can share with someone else.

But a file-transfer program such as *LapLink*, bundled with all of the floppyless notebooks I've seen, handles those jobs. The utility lets you use the floppy disk drives of an attached desktop PC as if they were the notebook's own, so it's easy to do the initial program load onto the notebook's hard disk. Similarly, the software makes it easy to get data *out of* the notebook, onto your desktop PC or someone else's.

Yet people tell me they don't like file-transfer programs, or they find them confusing, or they don't have a spare serial port on their desktop machine for the connection.

So? That just leads to an even better alternative: an external, plug-in floppy disk drive for the notebook, which doesn't travel with you but stays at your desk. How often, really, have you had to transfer data onto or off of your notebook's hard disk when you were on the road? (Forget e-mail and other file transfers by modem, since they don't use the floppy drive.)

I speak from experience here. I've used an external floppy drive with my notebook for more than a year. Not once have I wished for a built-in floppy drive. The drive stays at my desk and, I readily concede, is often a quicker way to move files than *LapLink*.

ILLUSTRATION: PETER FASOLINO

The one notebook design that stands (I should say *stood*) head and shoulders over all others in terms of size and weight was the Sharp PC-6220, also sold as the Texas Instruments TravelMate 2000 and the CompuAdd Companion 212. These identical 12-MHz 286 machines are 8.5 by 11 by 1.25 inches and weigh 4 and a half pounds. They share a big,

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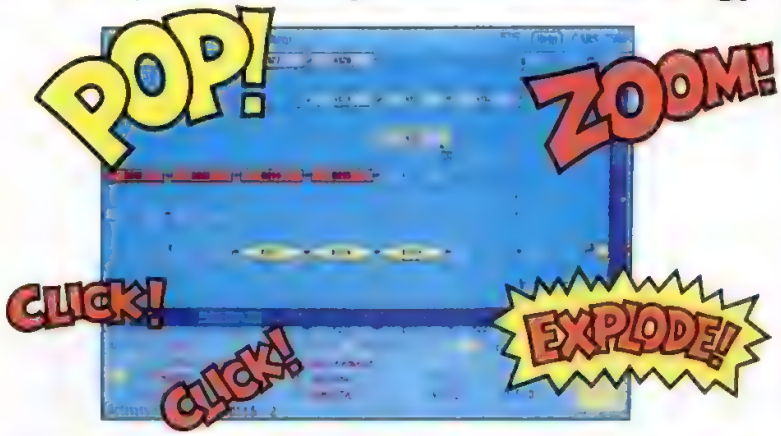

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backlit LCD and a fine keyboard. And they have no internal floppy drive.

Discontinued after only a few months on the market, as 1991's deluge of 386SX notebooks made 286 machines almost unsalable, they fell to their present $750 to $800 close-out prices. But many are still in daily use. *PC Magazine* publishing director Bill Machrone, fellow columnist John Dvorak, and I all still rely on them—though we could get our hands on any machine made. Because the human-factor issues of size and weight are so *right*.

As the new 386SXs and 386SLs come out, I've been disappointed that few vendors pay much attention to the design of the Sharp/TI/CompuAdd trio. There's no reason why "SXing" these machines should increase their weight by more than a couple of ounces. And there's no reason at all for them to grow thicker and heavier.

But they have. The prevailing form factor for 386SX notebooks has a thickness of 1.75 to 2 inches, and they weigh around 7 pounds. Again, the difference sounds small—till you tote one around.

But I said there is hope.

NEC, having produced some clumsy NotSoLites after the UltraLite, has gone back to its roots with the new UltraLite III. It's an SX notebook that weighs just 4.8 pounds and measures 9 by 11 by 1.5 inches—a little large but in the notebook ballpark. It's got a decent-quality backlit screen, a very good keyboard, and (hurrah!) no internal floppy drive.

Instead, NEC packs an external floppy drive with the computer. I won't call it "free," but at least NEC doesn't charge for it as an add-on. You can find the package on the street for about $2,400.

Prototypes I've seen lately of lightweight machines from other vendors also show new respect for this 8.5- by 11- by 1.5-inch 4.5-pound ideal.

Actually, that's not the ideal at all, but simply the best compromise with current technology. So-called "bibles," or "6-by-9s," bigger than palmtops but smaller than notebooks, will start appearing late this year—and smaller is almost always better.

For now, I hope vendors keep their eyes on the scale and the ruler, and get smart about built-in floppy drives. Seymour's Second Law: 7-pound PCs are not "notebook" computers. ■

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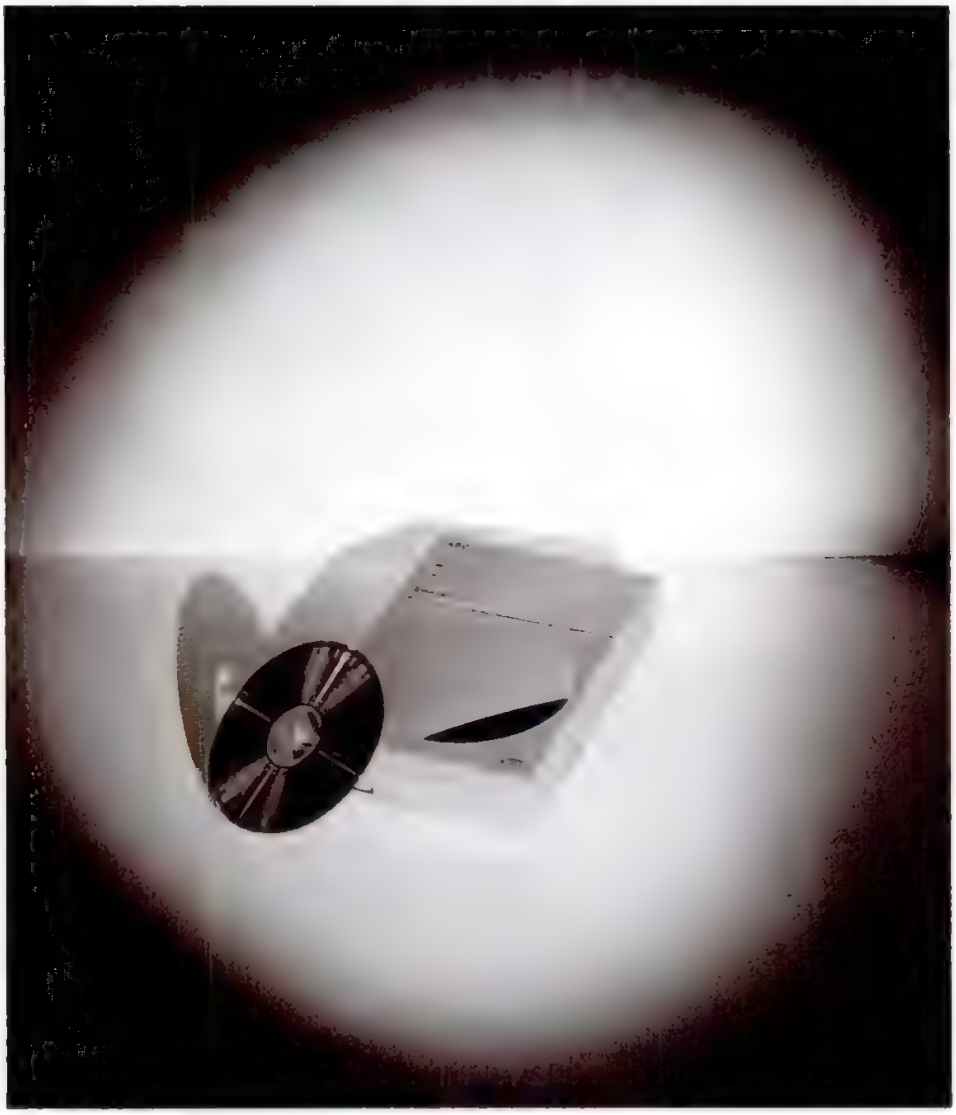

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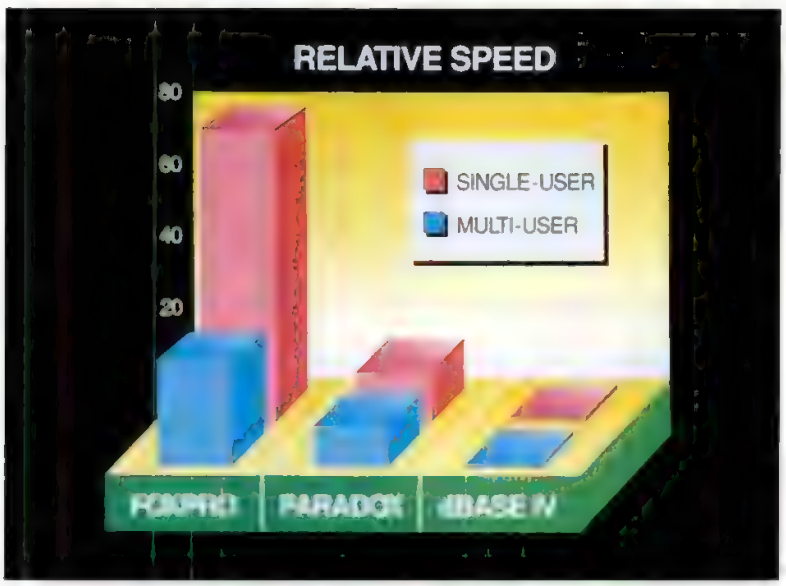

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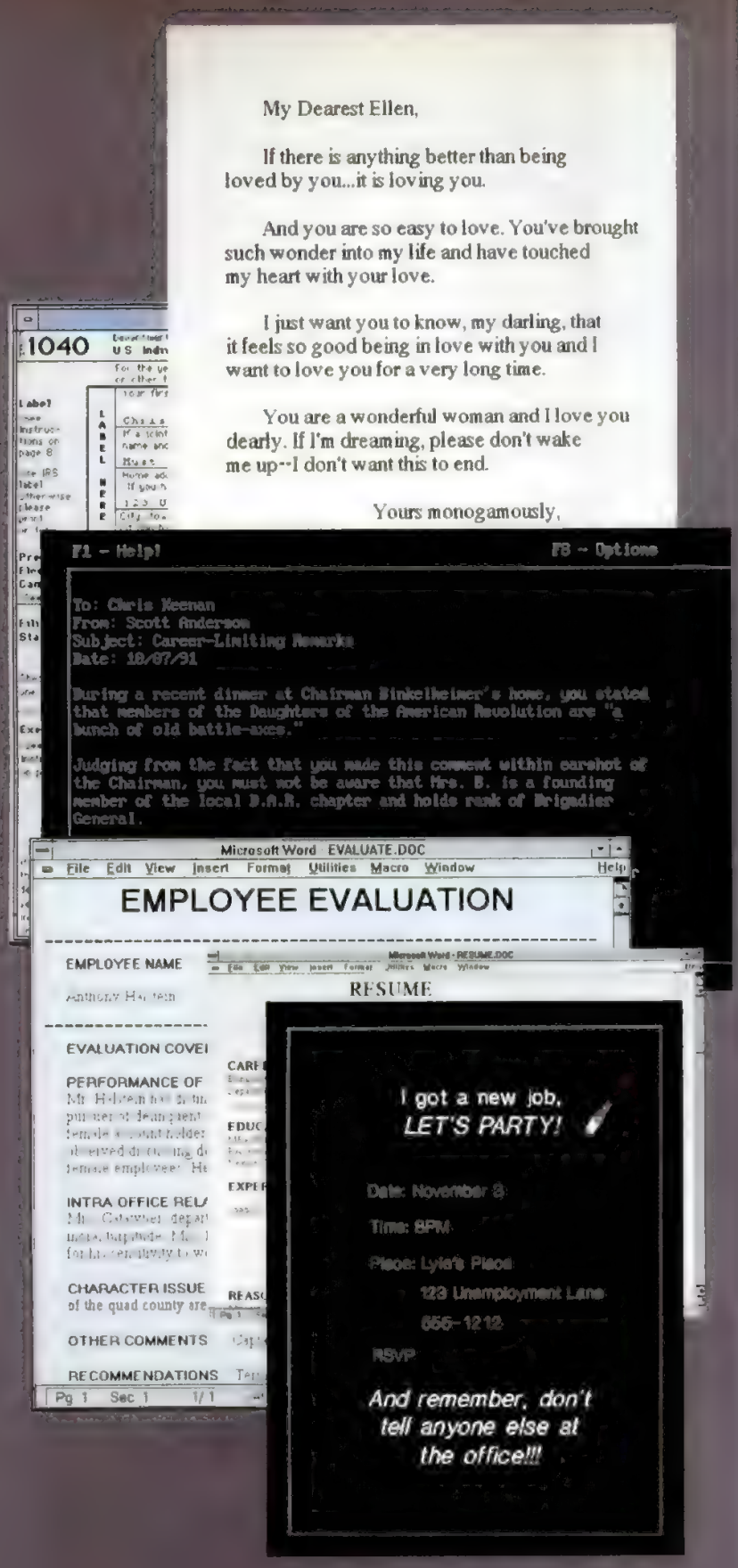

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Who benefits from rampant version revision?

Psychologist Robert Ornstein and biologist Paul Ehrlich, in their thought-provoking book *New World, New Mind,* refer to the "boiled frog" syndrome. If water is heated slowly to a fatal temperature, frogs sitting in water fail to notice until it is too late to jump out and save themselves.

Ornstein and Ehrlich use the example of these unfortunate frogs to set the context for a discussion of the inadequacy of human responses to problems like global warming and acid rain. They point out that, like the frogs, we often fail to react to unfavorable but gradual changes in the conditions around us.

That brings us to the costs of software and hardware upgrades. To be sure, neither has the destructive potential of the depletion of the ozone layer, the rising of the oceans, or the death of the forests. On the contrary, product upgrades often bring desirable added functions or performance. But they do bring added costs which, like the water heating up around the frogs, users may be slow to notice.

It has long been evident to people in business (and even to economists!) that a lot more of those frequently purchased products are sold each year than those you buy once.

Add the fact that consumers are often more willing to part with a large sum of money in a number of relatively smaller payments (even if the total is greater than a single large payment) and you've stumbled on not just the foundation for installment buying, but also the reason for the current wave of upgrade madness in the computer industry.

The application of this tactic to personal computer software is a relatively recent phenomenon. Its application to hardware is even newer. Some software has always lent itself to periodic upgrades. Tax preparation packages, for example, require new versions each year as laws and tax brackets change. Most software would never need upgrades except for better versions with improved performance and added functions. One needs or wants a new version of a program only if it really does something better or faster than an older version.

Toward the end of the 1980s, some vendors began to notice that they could increase their revenues if they released new versions of their software frequently and pushed them aggressively. Vendors could keep their products more competitive *and* capture a continuous revenue stream from users.

Borland was one of the first software vendors to use a strategy of frequent upgrades promoted by direct mail. Microsoft has mastered the art on an even grander scale with its DOS and Windows upgrades. Other software vendors have followed their example.

The hardware equivalent has now appeared in the form of "upgradable" or "modular" personal computers—the topic of a Jim Seymour column (PC Magazine, November 29, 1991). System vendors want to get in on the action and sell systems that can be upgraded—but only through the purchase of a new and more powerful system board from the same vendor. These proprietary upgrade boards are designed and priced to be high-margin (and therefore high-profit) items.

There's nothing fundamentally wrong with any of this. It is a perfectly legitimate way for vendors to pursue their business aims and to make money for their stockholders. But there's nothing wrong with users carefully examining what all these upgrades will really cost, either—not only the price for the upgrade, but labor, installation and training in its use as well.

ILLUSTRATION: PETER FASOLINO

If you want to get the best value out of your expenditures for hardware and software, you are well advised to ask a bit more diligently than you may have in the past: "What will the real cost of this product be over time? Is this upgrade really necessary?" If you fail to do so, you are likely to create more tangible benefits for vendors than for the user. ■

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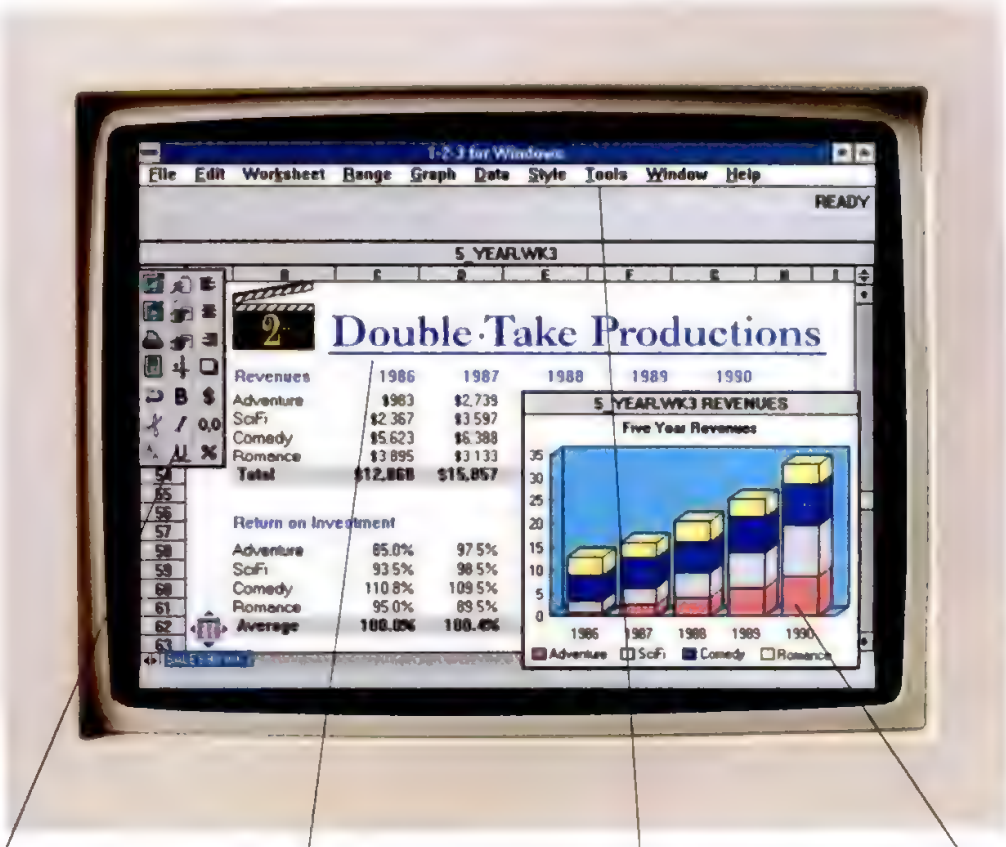

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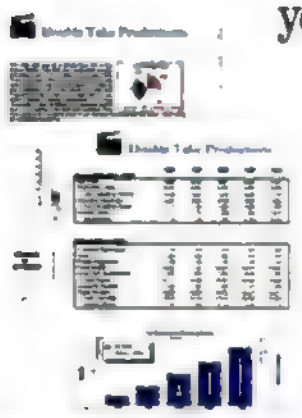

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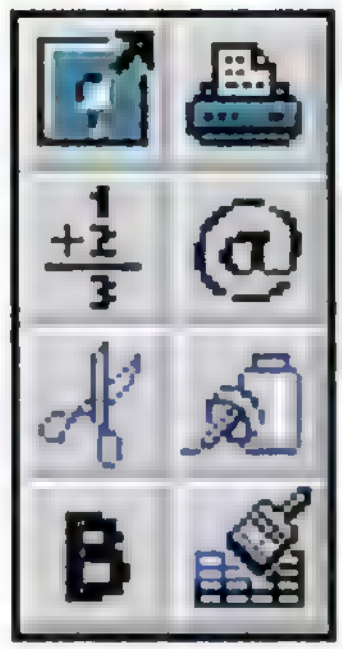

Customizable SmartIcons give you push-button access to basic and advanced spreadsheet functionality. Over 50 standard icons come with the program, or create new icons to suit your needs. For example, sum a column or a row, or change text to bold—all in a simple step.

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Lotus 1-2-3

1-2-3 for Windows

Lotus

*All registered 1-2-3 for Windows customers should have automatically received the Update Kits. This includes users who upgraded directly from Lotus or returned their registration cards to us before October 7, 1991. For more information on receiving an Update Kit, call 1-800-TRADEUP, ext. 6461. **Please have your credit card and product package ready when you call. In Canada, call 1-800-GO-LOTUS. © 1991 Lotus Development Corporation. All rights reserved. Lotus and 1-2-3 are registered trademarks and SmartIcons is a trademark of Lotus Development Corporation. Classic is a registered trademark licensed to Lotus Development Corporation. Microsoft is a registered trademark and Windows and Toolbar are trademarks of Microsoft Corporation. Adobe Type Manager and ATM are registered trademarks in the United States of Adobe Systems Incorporated.

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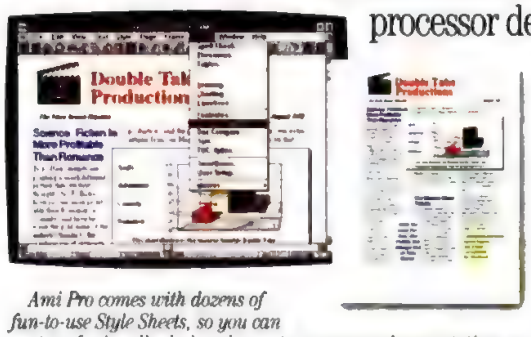

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—PC Magazine, November 12, 1991

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Power Gets Cheaper

by John R. Quain

Faster and cheaper: That's the legacy of Intel's 33-MHz 486 CPU. System vendors have gotten the message, too, and are offering the ultimate-power desktop PC for as little as $3,000. PC Labs tests 24 of the industry's top 486/33s.

IN THIS REVIEW

ALR BusinessVEISA 486/33 Model 200
ALR PowerPro VM 486/33 Model 150
Amkly 486/33E
Austin 486-33E Wintower
Austin 486-33I Winstation
Compaq Deskpro 486/33M
CompuAdd 433E Tower
Dell PowerLine 433DE
DTK FEAT-3300
Ergo Moby Brick 486DX
Everex STEP 486/33
Everex STEP 486/33e
Gateway 486/33C
GoldStar GS433
Hertz 486/33Ei
HP Vectra 486/33T
IBM PS/2 Model 90 XP 486
Northgate Power Plus 486 ZXP
Tangent 433e
Tangent 433i
Tri-Star Flash Cache 486 EISA
Twinhead Superset 600/433C
Zenith Z-486/33E
Zeos 486-33

Today's power king is tomorrow's entry-level machine. The 33-MHz 486DX, introduced only 19 months ago, is destined to follow the way of all PCs—from the domain of the high-end server to the mainstream user's desktop.

True, even a 386SX can handle basic business applications, but current applications, including Microsoft Windows 3.0, need a faster 486 to come alive. As prices plummet below $3,000 for a complete 486 PC, Intel's 33-MHz 486 is the engine

PHOTOGRAPHY: THOM O'CONNOR

of choice—not only for local area network (LAN) file servers but also for single workstations running computer-assisted design (CAD) and desktop publishing (DTP) software. Furthermore, many of the 24 33-MHz 486DX PCs reviewed here offer faster video subsystems, 32-bit bus architectures, and the possibility of upgrading to even faster CPUs such as the 486/50 or Intel's new clock-doubling chips.

386 TO 486: THE $300 DIFFERENCE

If you follow the market, you will find its race toward 486 systems is faster than expected. In 1991 International Data Corp. (IDC) estimated that 486-based PC sales reached 1.1 million units, which is about 12 percent of the market. According to IDC, in 1990 only 88,000 486-based PCs were sold, compared with 3.74 million 386-based PCs. Other consultants, such as Dataquest, offer even more optimistic predictions, but all agree that though 386 sales continue to grow, the 486 family is growing faster.

OUR CONTRIBUTORS

Bruce Brown, Alfred Poor, and **Winn L. Rosch** are contributing editors of *PC Magazine.*
Kellyn Betts, Joseph Desposito, Henry Fersko-Weiss, Patrick Honan, Edward Perratore, John R. Quain, and **Tom Unger** are frequent contributors to *PC Magazine.*

As the sole manufacturer of 486 chips, Intel is encouraging the 486 trend while Advanced Micro Devices (AMD) and others eat into its 386 business. From October 1990 to 1991, Intel dropped the price of the 33-MHz 486DX chip from $953 to $428. That translated into a mere $300 difference between similarly configured 386 and 486 machines by the end of 1991. Gateway 2000, for instance, recently advertised a $2,495 386/33 with 4MB of RAM and a $2,995 486/33 with 8MB. The systems were otherwise identical. That margin should narrow to less than $150 this year, according to IDC. A 33-MHz 486 typically performs PC Magazine Labs' Instruction Mix benchmark test in about 33 percent less time than a 33-MHz 386 PC, making the price/performance advantage very alluring, even when compared with its nearest competitors. A slower 25-MHz 486DX costs as much as a 33-MHz 486DX, and the new 50-MHz 486DX PCs still cost about $3,000 more than a typical 486/33.

The 486DX chip is often characterized as an enhancement of the 386 chip, adding a math coprocessor, an 8K cache, and a cache controller placed on the same chunk of silicon. It also includes design differences that distinguish it from the 386. Those differences enable the 486 to handle 32-bit software up to 45 percent faster than the 386, according to Intel. But since there hasn't been much 32-bit software, DOS applications will experience less sub-

SYSTEM CONFIGURATION AND PERFORMANCE: A GUIDE TO THE GRAPHICS

BENCHMARK TESTS

The Bars
These charts show each product's scores on four tests relative to the best, worst, and average scores of the products in this review. Each colored bar represents the **range** of test scores for the 33-MHz 486 systems, from fastest to slowest. *The longer the bar, the wider the range.* If the best score is more than twice as fast as average, an upward-pointing arrow appears atop the colored bar.

A black arrow on each bar represents the given system's **position** relative to the historical range. *The higher the arrow, the better the performance.* If a system performs more than twice as fast as average, the black arrow appears at the top of the bar, pointing upward.

The Boxes
A **normalized score** appears in the box below each colored bar. To derive this figure, we calculated the average score for all 33-MHz 486 systems tested and reviewed in the February 12, 1991; and April 16, 1991; issues of *PC Magazine.* We then divided this average by the score of each machine in turn and multiplied by 100.

Thus the average score is 100; a number greater than 200 indicates that a system performed the test in less than half the average time; a number smaller than 50 indicates that the system took more than twice as long to complete the test.

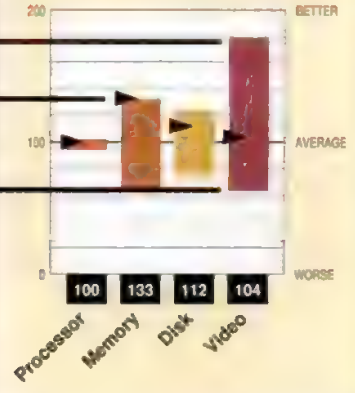
A table of **actual scores** accompanies the three-dimensional bar charts.

Best score
(previously reviewed products)

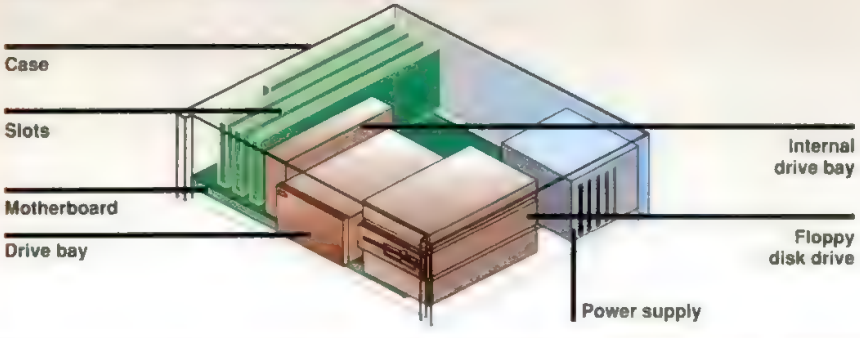
Product's score

Worst score
(previously reviewed products)

TEST RESULTS



INTERIOR CONFIGURATION DIAGRAM



Case Options include desktop, tower, minitower, small-footprint, and slimline.

Slots The number and length of cards represent the number and length of slots on the motherboard.

Drive bay A hard disk face plate indicates external access to a bay. Options include full-height, half-height, third-height, and 3.5-inch

Floppy disk drive A face plate indicates that either a 1.2MB or 1.44MB floppy disk drive was installed in our tested system

33-MHz 486-BASED PCs: INDEX

Model	Bus	Price of *PC Magazine* configuration at review time	80486 Instruction Mix test score (seconds)	*PC Magazine* review (issue date and page)
				APRIL 16, 1991
ACMA 486/33 EISA	EISA	$7,995	1.12	219
ALR PowerCache 33/4e	EISA	$15,562	1.12	224
Amax 486/33e	EISA	$9,300	1.09	227
Bus 486/33 EISA	EISA	$8,249	1.13	227
C² Saber 486 EISA	EISA	$8,100	1.12	234
PC Compaq 486/33L	EISA	$19,846	1.13	235
Dataworld Data 486i EISA	EISA	$11,367	1.12	236
Dyna Work Master 486 33 EISA	EISA	$8,219	1.18	238
Fortron NetSet 486-33 EISA	EISA	$7,950	1.09	238
Hi-Q 486/33 EISA	EISA	$5,999	1.12	242
International Instrumentation Blue Max Monolith 486E/330CD	EISA	$8,997	1.13	244
Matrix 486-33 EISA	EISA	$8,655	1.13	258
National Micro Systems Flash 486-33 EISA	EISA	$6,983	1.21	260
Netis 486/33 EISA	EISA	$5,939	1.11	264
Panther 486/33 EISA	EISA	$7,699	1.13	288
PC Pros/Touche 5550T/486 EISA/33	EISA	$6,299	1.12	297
Proteus 486/33 EISA	EISA	$5,400	1.10	297
SAI 486/33 EISA	EISA	$6,495	1.15	299
Tandon 486/33 EISA	EISA	$10,047	1.13	300
PC Tangent Model 433e	EISA	$9,698	1.09	302
Wedge 486/33 EISA	EISA	$6,675	1.10	303
PC Zeos 486-33 EISA	EISA	$7,120	1.12	306
				FEBRUARY 26, 1991
IBM PS/2 Model 95	MCA	$17,745	1.09	287
				FEBRUARY 12, 1991
ACMA 486/33 Engineering Workstation	ISA	$6,225	1.08	106
Amax PC/486 Power Station	ISA	$5,495	1.10	111
Arche Legacy ProFile 486-33	ISA	$13,734	1.08	112
Bitwise Model 433	ISA	$10,555	1.11	125
Blackship 486/33I	ISA	$6,827	1.10	127
Blue Star 486/33	ISA	$6,714	1.11	128
Boss 486 Model 4633	ISA	$7,995	1.09	133
PC Club Hawk IIITi	ISA	$6,100	1.08	150
Computer Market Place Ultra 486-33	ISA	$4,628	1.09	150
Diamond 486-33	ISA	$4,999	1.09	156
Dynamic Decisions Dynex 486	ISA	$7,495	1.08	158
Dyna Work Master 486 33 Cache	ISA	$7,979	1.12	160
Eltech Model 486-33	ISA	$5,559	1.08	166
Fortron NetSet 433i	ISA	$5,495	1.16	171
International Instrumentation Blue Max Monolith 486/33	ISA	$8,997	1.11	172
Micro Express ME 486-ISA/33	ISA	$7,224	1.12	176
Micro Telesis 486/33	ISA	$7,199	1.05	178
National Micro Systems Flash 486-33	ISA	$4,999	1.08	182
PC Northgate Elegance 486/33	ISA	$7,095	1.09	182
Novas OPTimum 486-33	ISA	$6,601	1.11	184
Panther 486/33	ISA	$4,999	1.12	189
PC Brand 486/33	ISA	$5,908	1.09	190
PC Pros/Touche 486-33 Model 5550	ISA	$5,499	1.08	199
Peregrine 486/33 Flyer	ISA	$6,999	1.09	200
SAI 486/33	ISA	$5,508	1.11	200
Standard 486/33	ISA	$5,995	1.08	203
Systems Integration Associates SIA 486/33	ISA	$10,555	1.11	205
Tangent Model 433i	ISA	$7,190	1.12	205
Tri-Star Flash Cache 486	ISA	$6,245	1.08	206
Twinhead Superset 600/433	ISA	$6,225	1.12	211

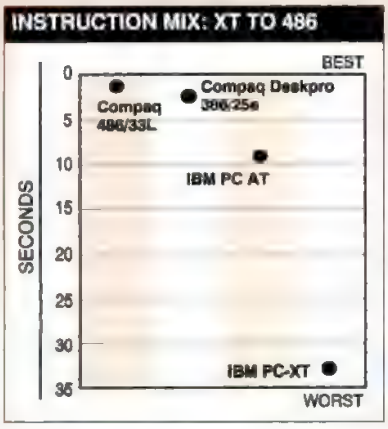
PC—Editors' Choice

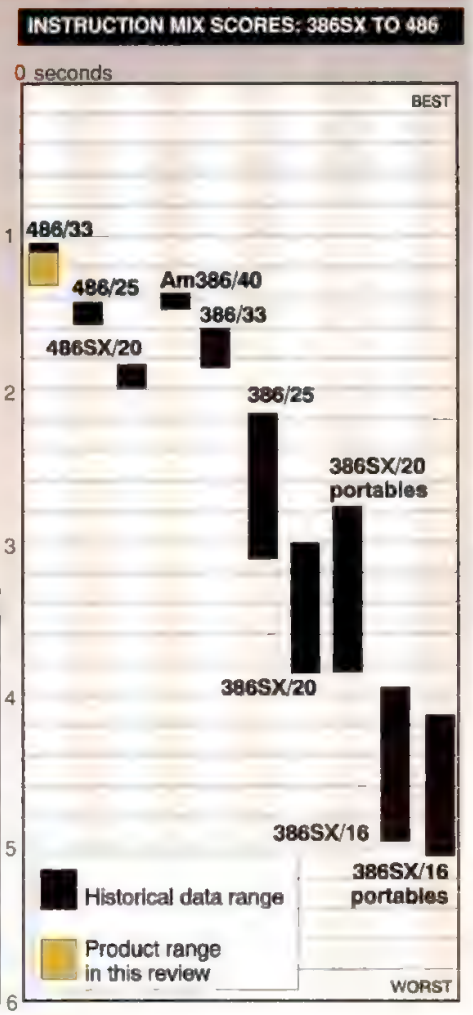
PROCESSOR PERFORMANCE COMPARED

PC LABS

33-MHz 486s continue to show little difference in processor speed. The average 486/33 performs PC Magazine Labs' Instruction Mix test in 25 percent less time than the average 486/25.

The large chart, right, shows the range of Instruction Mix benchmark test scores, from fastest to slowest, for PCs tested by PC Magazine Labs over the past two years. The chart below shows the average Instruction Mix scores for the Compaq 486/33L, the Compaq Deskpro 386/25e, the 4.77-MHz IBM PC AT, and the 6-MHz IBM PC-XT. (The figures in both charts have a 0.05-second margin of error.)





stantial improvements. And though IBM, Microsoft, and Sun Microsystems are now pushing 32-bit operating systems (OS/2 Version 2.0, Windows NT, and Solaris, respectively), it is unlikely that these operating systems will show up on desktops within the next year or two. The most significant piece of 32-bit software continues to be *NetWare 386*.

REVIEW CRITERIA

When *PC Magazine* inquired about 33-MHz 486DX systems, we captured more than 80 vendor responses—too many to review in one issue. Using market data and analysis, we narrowed the field to 20 industry leaders: ALR, Amkly, Austin, Compaq, CompuAdd, Dell, DTK, Ergo, Everex, Gateway, Goldstar, Hertz, HP, IBM, Northgate, Tangent, Tri-Star, Twinhead, Zenith, and Zeos. Though this group doesn't represent every 486/33 on the market, it shows where the market leaders are headed—and where the smaller companies are likely to follow.

We requested systems with 8MB of RAM, a 200MB hard disk (or the nearest size offered), a Super VGA color monitor and video adapter, a 1.2MB or 1.44MB floppy disk drive, one parallel and two serial ports, and DOS 5.0. This provided an interesting diversity, from the compact, 8.5-pound Ergo Moby Brick 486DX to towers like the HP Vectra 486/33T and the multiprocessor-capable ALR PowerPro VM 486/33 Model 150. This group also covers a broad price spectrum, from the $2,695 Austin 486-33i Winstation to the $13,170 IBM PS/2 Model 90 XP 486 (most likely available for a price between $9,000 and $10,000 on the street).

Even though more than 50 of the 83 systems we discovered employed the ISA bus, the industry leaders in general have adopted 32-bit buses. Of the 24 PCs we review here, 13 are EISA (Extended Industry Standard Architecture) systems, one utilizes IBM's MCA or Micro Channel architecture (guess which), and the remainder use the original 16-bit ISA (Industry Standard Architecture) bus. Austin, Everex, and Tangent each submitted an EISA and an ISA system. So the trend is clear: Move over, ISA, the 32-bit bus is coming on strong.

The advantages of 32-bit EISA and MCA buses over 16-bit ISA buses are not apparent in typical DOS applications. Consequently, PC Labs' suite of DOS benchmark tests does not reveal any significant differences among the architectures represented in this review. However, buyers should consider how much data traffic their 486s will have to direct—particularly if they are shopping for a file server or expect to use multimedia applications. The ISA bus can manage a data transfer rate of 4MB per second. The EISA bus can transfer 33 MBps, and the basic rate for MCA is 20 MBps.

Given how difficult it is to clog up even a 4-MBps path, the central issue is CPU drain. A 32-node network can tax a 486 CPU on an ISA PC, but it won't even make an EISA system's CPU breathe hard—in part because bus-mastering network and disk controller cards take some of the strain off the CPU. (An upcoming story on EISA and MCA LAN servers will reexamine some of the current PCs to see how they perform as servers.) Even individual users can appreciate the wider bus. Multimedia applications, with their 24-bit color graphics combined with animation, music, and scanned color images, will most likely frustrate ISA system users.

AN UPGRADABLE FUTURE?

Capitalizing on buyers' fears of obsolescence, many manufacturers hold out another security blanket: upgradability. Upgradable designs may include removable CPUs (à la the Northgate Power Plus 486 ZXP), daughterboards (as with the Amkly 486/33E), or modules (like that of the IBM PS/2 Model 90 XP 486). Nearly half of the PCs in this group are specifically designed as upgradables—and that includes six EISA PCs and the IBM computer. Industry experts, however, have suggested that there is more inventory control than sophisticated design philosophy behind the upgrade trend.

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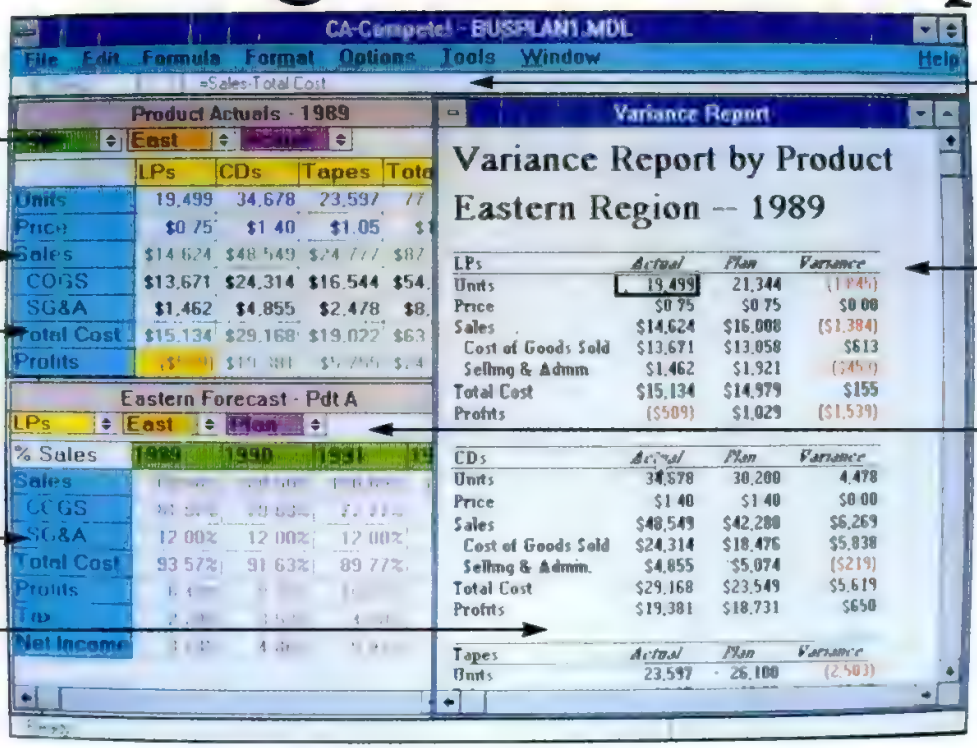

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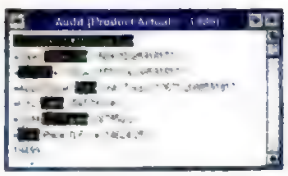

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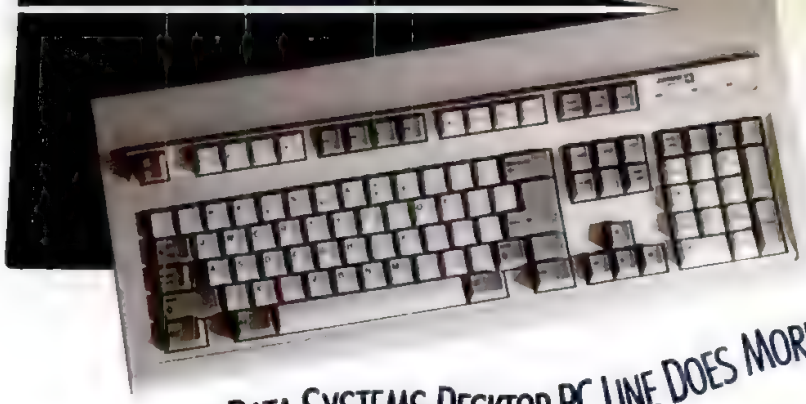

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Co-Processor	Optional 80387SX	Weitek 4167 socket i486DX upgrade	Weitek 4167 socket i486DX upgrade	Weitek 4167 socket	Weitek 4167 socket	Optional 80387SX
Memory (Std./Board Max.)	2MB/16MB	4MB/32MB	4MB/32MB	4MB/64MB	8MB/64MB	1MB/10MB
Expansion Slots	4 open 16-bit ISA	3 open 32-bit EISA	3 open 32-bit EISA	3 open 32-bit EISA	8 open 32-bit EISA	2 open 16-bit ISA
Hard Disk Drive	40MB or 80MB IDE	80MB or 200MB IDE	200MB IDE	200MB or 400MB IDE	340MB half-height SCSI, 6 open half-height bays	Diskless or 40MB IDE
Ports	2 serial, 1 parallel	2 serial, 1 parallel	2 serial, 1 parallel	2 serial, 1 parallel	2 serial, 2 parallel, 1 mouse	2 serial, 1 parallel
Disk Drive Controller	Combined IDE connector/ floppy controller	Combined IDE connector/ floppy controller	Combined IDE connector/ floppy controller	Combined IDE connector/SCSI/ floppy controller	EISA bus master SCSI mass host adapter	IDE connector/ floppy controller
Video	16-bit VGA	16-bit VGA	TIGA/VGA	TIGA/VGA	16-bit VGA	16-bit VGA
LAN Features					Optional RAID 5 disk array software	Dual level ROM-based password protection

Novell LAN Tested & Approved

*The Z-486/33ET has been tested for compatibility with Novell NetWare® and Microsoft LAN Manager™
The Z-486/33ET has been submitted for testing and compatibility with Banyan® VINES™ and SCO™ and ISC™ UNIX®

Z-386SX/20

Z-486SX/20E

Z-486SX/25E

Z-486/33E

Z-486/33ET and Z-LS/20

POWER FROM A NEW PERSPECTIVE. YOURS.

Furthermore, not all CPU upgrades will pay off in superior performance: Beware of small upgrade cards bearing only a CPU and clock crystal. If you are dreaming of a 50-MHz 486, you will need a specially designed cache architecture to operate memory at 50-MHz performance levels. That means using a module such as IBM's processor complex or Amkly's CPU card. You will also need plenty of ventilation to dissipate the additional heat. Then ask yourself whether you will go to the expense of paying for a full upgrade (current CPU modules can cost as much as $1,800), or if you are willing to wait for the arrival of lower PC prices, faster hard disks, and quicker video subsystems.

To date, ALR, Dell, and Zeos have announced they will sell 486/50 modules. Compaq says the Deskpro 486/33M can support a 486/50 chip, but it has no plans to bring out such a module. In the first half of 1992, Intel plans to add a new wrinkle to the upgrade uproar: new 486 chips that operate at two speeds. Dubbed *dual-clock* chips by industry followers, these new 486s will run at different internal and external speeds. For example, a dual-clock 66-/33-MHz 486 CPU will operate at 66 MHz inside and 33 MHz outside. The advantage is that all the other chips and logic on the motherboard can still operate at 33 MHz, eliminating the need for expensive 66-MHz support chips and controllers. Intel expects to release chips to double the internal processing speed of 20-MHz 486SX, 25-MHz 486DX, and 33-MHz 486DX CPUs, but not the 50-MHz 486DX. The new chips will fit in the 487 performance upgrade socket, and Intel says it expects the performance of a clock-doubled 33-MHz processor to equal or exceed that of the 486/50. Many systems in this group already include that socket on their motherboards. In such cases, all you will have to do to upgrade is plug in the new dual-clock chip.

More important, Intel sources say the dual-clock chips will also be available as replacements for current 486DX CPUs (that is, they will be "pin compatible" with the 486DX chips). At least one vendor, Northgate, has anticipated this by seating its CPU in a zero-insertion-force socket for easy chip replacement. To complete the upgrade, some PCs may require a BIOS update, but as long as your system supports the clock-doubler chip—or comes with an upgradable BIOS—you can most likely move to the new chip.

PRICE/PERFORMANCE INDEX: 486/33 PCs

The $4,995 Tangent 433e (an EISA machine) stands out on the chart because of its hard disk performance, which benefited from a cached and coprocessed disk controller. The real bang for the buck, however, comes from the low-priced and ISA-based systems from Austin and DTK. Two of the biggest names—Hewlett-Packard and IBM—have the poorest price/performance ratios.

From a strictly price/performance point of view, no other machine can beat the Austin 486-33i Winstation and DTK FEAT-3300. Each sells for less than $3,000—inexpensive enough to compensate for their vanilla nature. Of the three, the best performance comes from Austin's Winstation, thanks to a fine video test score.

At another level, the Tri-Star Flash Cache 486 EISA, Everex STEP 486/33, and Hertz 486/33Ei produced high scores for performance and features, yet they come with moderate price tags. Any one of these systems would be a sound choice.

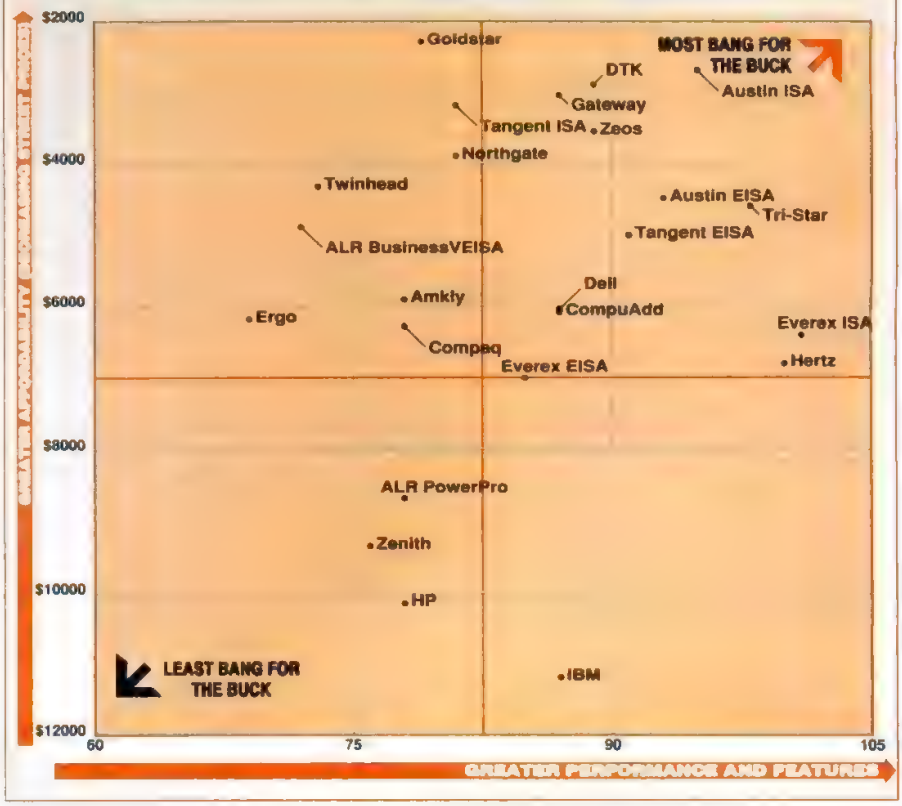
The Hertz and Tri-Star units benefited from larger hard disks than we requested (though the CompuAdd 433E Tower and IBM PS/2 Model 90 XP 486 have similar-size drives that failed to boost either system into this category); the ISA-based Everex unit's speedy video test score boosted its rating.

In this roundup, however, the name-brand tier is more spread out than usual. At the expensive end are the HP Vectra 486/33T and the IBM PS/2 Model 90 XP 486. These computers sell for more than $10,000 each (though our 15 percent dealer discount may be a bit stingy). The Compaq Deskpro 486/33M is more expensive than the CompuAdd 433E Tower and Dell PowerLine 433DE though its performance/features score is 9 points lower.

THE DATA POINTS

The performance/features axis of the Bang for the Buck chart is based on ten data points: the four benchmark test scores, installed RAM, disk capacity, VGA RAM, free slots, drive bays, and extras (miscellaneous items such as free bundled software, mouse, on-site service, FCC Class B certification, extended warranty policy, and flash EEPROM). A set of weighting factors has been applied to the raw numbers; you can find this data in the Software Library of PC MagNet's Editorial Forum as 01BANG.WK1.

Location on the *y*-axis is based on each system's tested-configuration price (as listed in the fact file). We applied a 15 percent discount to the list prices of dealer-distributed systems to approximate street prices.



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PC Week, Aug. 26, 1991

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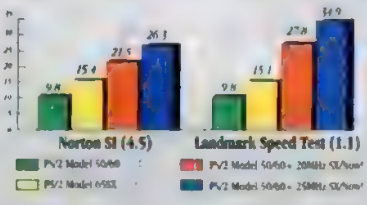

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COPROCESSED OR ACCELERATED VIDEO?

If you plan to do anything other than turn your PC into a file server, you will need speedy video. All that processor power won't do you much good if you cannot get the information to the screen quickly. For Windows users, the decision is clear; ordinary $100 Super VGA video adapters just won't cut it anymore. To meet the graphics demands and processing speeds of these systems, nothing less than an accelerated or coprocessed board will do. Expect to pay an extra $200 to $300 for this performance boost.

In this group of 486s, seven PCs have video subsystems specifically designed to increase Windows speed: the Austin 486-33E Wintower, the ALR BusinessVEISA 486/33 Model 200, the ALR PowerPro VM 486/33 Model 150, the Northgate Power Plus 486 ZXP, the Tangent Model 433e, and the Tangent Model 433i. We saw two different video adapters, the Actix Quantum and Orchid Fahrenheit 1280°, both based on an accelerator from S3 (pronounced "S cubed"). The S3 accelerator has certain common Windows routines built into its circuitry and is therefore able to perform BitBlts (bit-block transfers) and image transfers, which are normally managed by the CPU. On PC Labs' video test, the S3-controlled video adapters did not perform as well as regular adapters in DOS applications. Also, this accelerator is not the same as a coprocessor, which can be programmed and can

EDITORS' CHOICE

- **Austin 486/33i Winstation**
- **Tangent 433e**
- **Zeos 486-33**

Our three Editors' Choice PCs—the Austin 486/33i Winstation, the Tangent 433e, and the Zeos 486-33—offer a lot of computer for a little cash. Since we couldn't find major performance differences between ISA and EISA machines in the desktop environment, we looked at other features when we picked these systems: video abilities, expansion capacity, overall design, and bang for the buck. To meet the *PC Magazine* configuration, all come equipped with at least 8MB of RAM, a 200MB hard disk, Super VGA video, a color monitor, and DOS 5.0.

Austin Computer Systems' Winstation gets the top award for a small-footprint design that nevertheless gives the user fine versatility: up to 32MB of RAM on the motherboard, as many as six open slots, and room for four drives. There's no better machine for saving space on a crowded desk. To top it off, Austin sells this package for just $2,695—an unbeatable bargain, including a year of on-site service.

For virtually the same reason, the Zeos 486-33 gets an Editors' Choice. Packed in a tower case, this $3,545 computer includes a software bundle of Microsoft Windows 3.0, *Ami Pro*, and *Lotus 1-2-3 for Windows*. Like the Winstation, the Zeos 486-33 has an FCC Class B certification.

THE ULTIMATE FILE SERVER

Unlike desktop systems, a file server will most likely benefit from an EISA bus and preferably an EISA disk controller. Other musts: good expansion space, a roomy case (so air can circulate around the PC's components), and a power supply that can support as many devices as the system can hold. The Tangent 433e provides most of these features for less than $5,000. This EISA tower performs phenomenally, with a caching and coprocessed disk controller from Mylex, eight expansion slots, and a 300-watt power supply. A video card based on the S3 graphics accelerator would make this system equally capable on the desktop. As a server, the Tangent 433e's biggest shortcoming in the server environment is its room for only five drive bays. We awarded a similar Tangent system Editors' Choice in our April 16, 1991, look at EISA 486/33s.

OTHER GOOD CHOICES

Four other systems had impressive qualities: the ALR PowerPro VM 486/33 Model 150, the Hertz 486/33Ei, the HP Vectra 486/33T, and the Zenith Z-486/33E.

With its dual-processor capability, the PowerPro would be a fine choice as a file server if it had more drive space. Like the $4,995 Tangent 433e, this one holds only five half-height drives, but it costs $10,222 (before dealer discounts). You can buy a separate cabinet that holds as many as five additional full-height disk drives, but that option costs $6,000. Otherwise, the PowerPro has plenty of room for up to eight EISA and two ISA cards. ALR sent us its top configuration, including an expensive high-resolution video card. Save some money: Consider buying this system with standard video.

For the computer equivalent of a Sherman tank as your file server, you have two choices: the HP Vectra 486/33T and the Hertz 486/33Ei. HP is best known for the ruggedness of its systems, its reliability, its high-end options (such as SCSI-2), and its service and support for networks. If budget is not an issue, the Vectra is probably your best bet of all. Though it's an expensive system ($11,929 before standard retail-channel discounts), the Vectra gives you room for 6 half-height drives and 12 EISA slots. Most important, HP will provide the service you need.

With room for 64MB of RAM, eight drives, and ten slots, there is no bigger server than the Hertz unit. This is an Intel box resold by Hertz (primarily in the northeast), and as rugged a machine as you can buy.

For CAD or intensive graphics work, only the sturdily built Zenith Z-486/33E comes with a programmable TIGA-based video card. This card goes one step further than cards with the S3 video accelerator, which is most effective for speeding up Windows applications. The card contains a TMS34010 chip instead of the newer-generation TMS34020. And at nearly $11,000 (including the $1,700 15-inch Zenith 1650 monitor, which supports TIGA video), this system is a budget buster. Watch for retail discounts.

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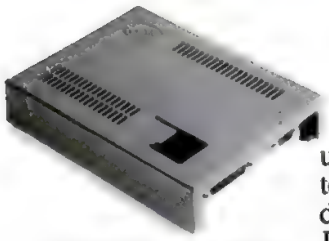

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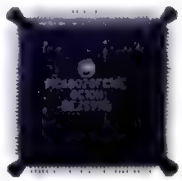

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PRINTERS. PAGES AHEAD.

speed up all types of graphics operations. Though more operations may benefit from a coprocessor, such as Texas Instruments' TMS34010 or TMS34020 chip, an accelerator can give software running under Windows substantial speed gains at a lower cost (this was discussed in First Looks, November 26, 1991, page 52).

Applications such as *AutoCAD* may benefit from coprocessed video cards, but the price is high: typically $1,000 or more. Only one system in this review contained a coprocessed card: The Zenith Z-486/33E uses the TMS34010 chip. If you need fast redraws and renderings in a variety of environments, look to programmable coprocessors for flat-out graphics speed.

MATCH MONITORS TO GRAPHICS ADAPTERS

To complement the video adapter, the monitor you will want should be capable of managing all the resolutions and frequencies you will need. Some vendors, such as ALR, include only a basic Super VGA color monitor, even though the standard video adapter may be capable of a much higher resolution. In addition, *PC Magazine* recommends that for flicker-free images, your monitor should meet the Super VGA vertical refresh rate of 72 Hz, which is specified by the Video Electronics Standards Association (VESA). CompuAdd, Everex, Gateway, Hertz, Twinhead, and Zenith supplied monitors with lower refresh rates. If your work requires a 1,024-by-768 resolution, make sure both the adapter and monitor can deliver it in a noninterlaced mode. Also, since 1,024-by-768 mode on a 14-inch monitor is virtually unreadable, you will probably require a monitor with a larger screen.

As always, keep in mind expansion possibilities when you are reading these reviews. A desktop graphics workstation should start out with five open expansion slots; a file server is best equipped with eight. Most users will find our hard disk requirement is the minimum needed for today's gluttonous graphical-interface applications, and network file servers will need more. Most systems come with both a 1.2MB and a 1.44MB floppy disk drive. Several companies, such as Northgate, also plan to offer new combination 1.2MB/1.44MB floppy disk drives from Canon and TEAC America that fit within a standard half-height 5.25-inch bay. Ask if you can substitute one of the new dual drives. You will get an additional accessible bay for tape backup and CD-ROM expansion and even save some money: The combination drives typically sell for about $120, compared with $70 for individual drives.

Remember that even though these 24 systems offer faster, cheaper, and better performance, you are still paying a lot of money for computing power. Insist on a good service and support package. Expect a 30-day return policy from mail-order outfits and 24-hour seven-day-a-week free phone tech support. If you're trying to meet a deadline late on a Sunday and you encounter problems, that great price you paid won't help save your job.

ADVANCED LOGIC RESEARCH INC.

ALR BusinessVEISA 486/33 Model 200

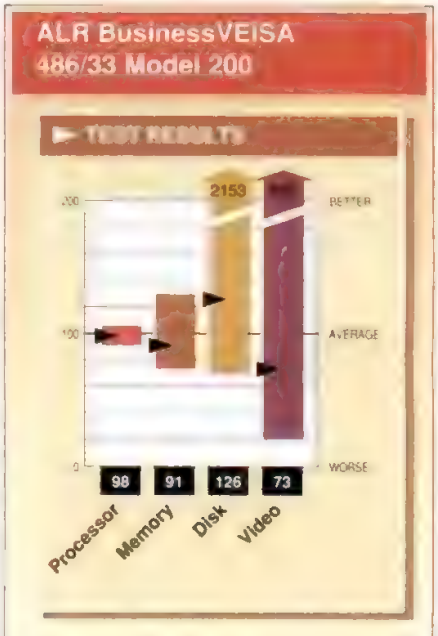
by Kellyn Betts ■ You can't win 'em all. Though the ALR BusinessVEISA was named an Editors' Choice in our recent review of upgradable systems ("Upgradable PCs: Betting on Tomorrow," *PC Magazine*, October 29, 1991), its superiority is less clear in this review based on processor class. The ALR BusinessVEISA 486/33 Model 200's performance, price, and features are all quite good, but none are outstanding.

The ALR BusinessVEISA 486/33 Model 200 is the latest member of Advanced Logic Research's series, and it retails for a considerable amount less than the models we previously reviewed. Even so, among machines aimed at single users, the BusinessVEISA's $5,742 price tag puts it on the expensive side—even compared with some of the other small-footprint EISA desktop PCs in this review. Like most of these systems, the BusinessVEISA is upgradable (from a 386/33); its 486/33 processor is found on a card that plugs into a special socket on its motherboard. At present, this processor card represents the top-of-the-line option, but ALR has promised that it will announce a 486/50 shortly.

ALR builds an extra megabyte of RAM into its motherboards. This means that the BusinessVEISA we reviewed came with 9MB. Space constraints on the well-packed motherboard restrict it from holding more than 5MB (using 1MB SIMMs), so the other 4MB was found on a card that

fit into a second proprietary socket on the motherboard. Nonetheless, using 4MB SIMMs, the machine can hold up to 49MB of RAM: 17MB on the motherboard and the rest on a card. A third proprietary socket designed for external cache was empty on the machine we tested. Even without a cache, the card turned in a very good processor score and did well on the memory test.

ALR aims this system at high-end graphics and CAD (computer-aided design) users. Such power users who plan to put the BusinessVEISA on their desktops will be pleased by ALR's inclusion of the



In Short: The $5,742 ALR BusinessVEISA 486/33 Model 200 features the same processor card as the company's more powerful ALR PowerPro VM 486/33 Model 150, but its components suit a desktop rather than a network environment. The 15-millisecond 200MB IDE hard disk is more than adequate, as is the 80-nanosecond DRAM. The Orchid Fahrenheit 1280° video subsystem seems appropriate for high-end graphics and CAD users who choose the BusinessVEISA.

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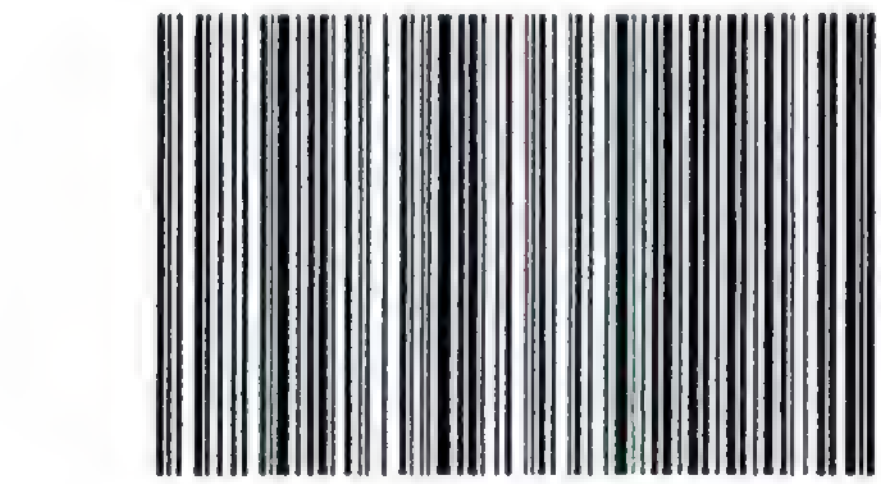

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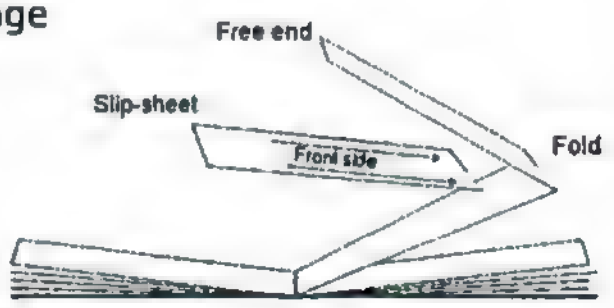

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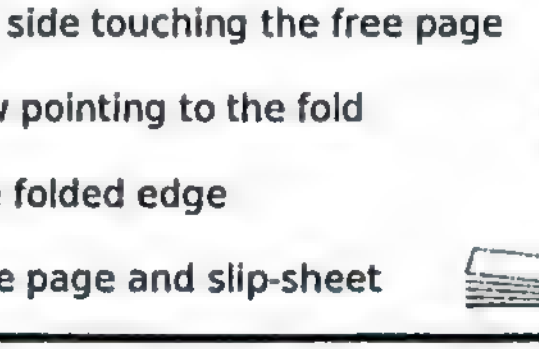

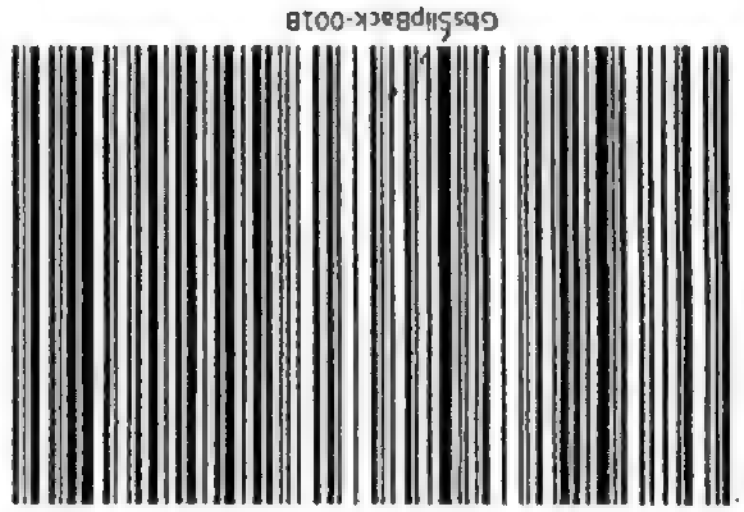

Back

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Inverted Back

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For the first time in the six-year history of *Computer Shopper* magazine's Best Buy competition, one company swept all of the awards in the desktop PC categories. At COMDEX/Fall '91 in Las Vegas, Gateway 2000 was awarded Best Buy honors for 286, 386SX, 386 and 486 desktop computer systems.

Our thanks to Gateway's own Semi-Gold Dancers played by en

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It's really no surprise Gateway 2000 systems were singled out as Best Buys since Gateway sells more computers through the direct channel than any other PC manufacturer. This in itself is testament to the value Gateway 2000 offers.

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- 1.44MB 3.5" Drive
- 40MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey™ Keyboard
- MS DOS® 5.0

$1345

16 MHz 386SX

- Intel® 80386SX Processor
- 2MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 40MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
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- Microsoft® Mouse
- MS DOS 5.0
- MS Windows™ 3.0

$1445

20 MHz 386SX

- Intel 80386SX Processor
- 32K Cache RAM
- 4MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 80MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

$1745

25 MHz 386

- Intel 80386 Processor
- 4MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 80MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

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33 MHz 386

- Intel 80386 Processor
- 64K Cache RAM
- 4MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 200MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

$2395

33 MHz 486

- Intel 80486 Processor
- 64K Cache RAM
- 8MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 200MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0
- MS Windows 3.0

$2945

33 MHz 486 EISA

- Intel 80486 Processor
- 128K Cache RAM
- 8MB RAM
- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- 340MB 15ms SCSI Drive with 128K Multi-Segmented Cache
- 32-Bit EISA SCSI Controller
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4. Close the page and slip-sheet

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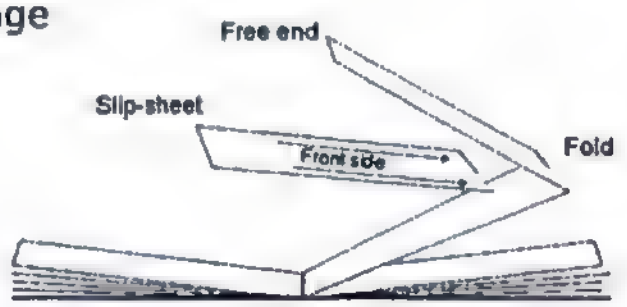
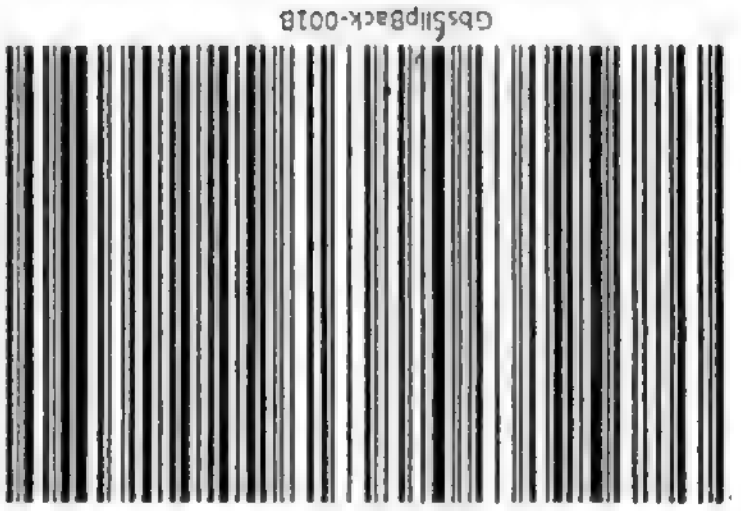
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet





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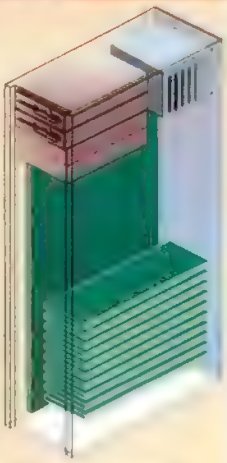


ALR PowerPro VM 486/33 Model 150
Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770.
List price (tested configuration): $10,222.
Memory and processor RAM cache: 9MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Seagate 18-ms. 150MB ESDI hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 512K RAM, ALR 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 482 ON READER SERVICE CARD

3.0, or even OS/2, however. At present, only special versions of SCO's Unix and Banyan's *VINES* networking software can take advantage of the second processor, though Novell expects to have a version of *NetWare* for dual processors in the future. But if you buy this system, you can replace the processor card and move up when it makes sense for you. In order to use one or both of the full-length processor-cache cards the PowerPro supports, you must give up one or both of your 16-bit ISA slots; the cards cover up the ISA slots. (The smaller processor and cache cards that came in the system we reviewed were placed directly in line with the 16-bit slots, so we found that only half-length 16-bit boards would fit across from them.)

ROOM TO GROW

If the ALR PowerPro VM's impressive size, processing options, and price do not convince you that it is the ideal network server, its whopping eight free slots will definitely make up your mind for you. Not including the two processor card slots, the system has a total of ten available: eight for EISA cards and the other two for 16-bit ISA cards. This translates into more built-in slot space than any of the other systems in this roundup offer—save the Hertz 486/33Ei, which also gives you ten slots.

Considering its apparent purpose as a file server, the PowerPro's high-end video subsystem seems an odd choice. The Orchid Fahrenheit 1280° card did not excel on PC Labs' video benchmark test because our test focuses on VGA character mode. The S3 graphics accelerator chip on the card is optimized for displaying Windows; extra tests proved the card's impressive ability to manipulate graphics images.

The problem is that you really do not need to run Windows on a network server. Sure, a real hardware hog might want to buy this system for personal use, but the PowerPro is meant to be a server. Its size, price, and level of expandability attest to this, as does the fact that the basic-configuration price does not include a video subsystem. ALR also sells a much less powerful VGA video card and monitor for $873 less than the system it sent us for review.

Most network servers require a hard disk much larger than the 150MB unit we tested, which is the smallest hard disk ALR will sell with the PowerPro. The company sent us the 150MB unit because we requested a noncached 200MB hard disk; the next-largest hard disk ALR offers is a cached 330MB unit. The 18-millisecond Seagate nonetheless performed quite well on the disk test. Its internal location on a hinged swing-out brace also makes for easy motherboard access.

One of the larger hard disk options, which go up to 1.2GB, will probably fit your needs for data storage. That is fortunate, since the computer has only two additional half-height bays free. You will probably want to add a tape drive, and users who want state-of-the-art equipment may even use the last bay for a CD-ROM drive. ALR does offer a $5,999 mini computer-like case for extra drives. The PowerPro fits inside this case, together with a 330MB hard disk, five more full-height drive bays, and an 800-watt uninterrupted power supply.

The PowerPro is backed by the same one-year parts-and-labor warranty as the ALR BusinessVEISA 486/33 Model 200. If you are looking for a network server that will grow with your needs, the ALR PowerPro VM 486/33 Model 150 is unquestionably one of the best computing investments you can make. And at $9,349 for a system with a generic VGA subsystem, the price is a reasonable investment for this level of technological sophistication.

AMKLY SYSTEMS INC.

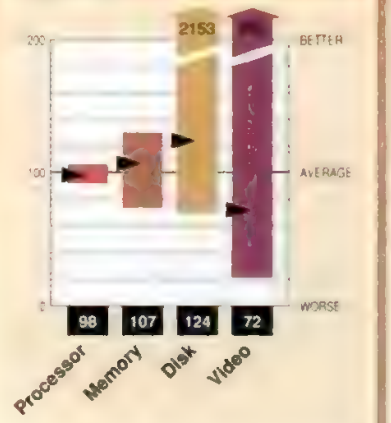
Amkly 486/33E

by John R. Quain ■ Amkly Systems' upgradable EISA desktop PC was previously reviewed in its 25-MHz 386DX incarnation, which garnered an Editors' Choice award ("Upgradable PCs: Betting on Tomorrow," October 29, 1991). Now Amkly has introduced a 33-MHz 486DX CPU module. The Amkly 486/33E's design makes CPU upgrades easy, but this small-footprint PC's performance is less impressive than that of other 33-MHz systems featured here.

A proprietary full-length CPU card contains the 486DX chip, in addition to the system crystal, a Weitek-compatible socket, and four 4MB SIMM slots. That means you can boost the system to its 16MB limit without forfeiting your original memory investment ($645 for 8MB). Amkly uses no external SRAM cache, but its memory test timing stayed ahead of those produced by most of the systems in this group.

Amkly 486/33E

TEST RESULTS



In Short: A desktop EISA PC that once garnered an Editors' Choice for its forward-looking upgradability, the 33-MHz Amkly 486/33E does not measure up quite as well against the current group of contenders. At $6,950, this PC has a moderately high price. In addition, users who want fast CAD and DTP performance will be disappointed with the system's video test score.

The Amkly 486/33E's motherboard has six EISA expansion slots; all were unoccupied in the configuration we tested. Amkly placed all the ports, including a PS/2-style mouse connection, on the motherboard. A Trident VGA controller is also integrated. The latter feature proved to be this system's weak link. Able to reach a 72-Hz vertical refresh rate in noninterlaced Super VGA with 256 colors, the Trident VGA controller has typically produced poor video times on PC Magazine Labs' benchmark test. This system was no exception. You can disable the controller, but Amkly does not currently offer any video alternatives based on EISA cards. To get such cards, you will have to go to outside sources such as American Megatrends, Axik, and Orchid Technology.

Most users will still be pleased with Amkly's 14-inch Super VGA monitor, which uses a Sony Trinitron CRT. The monitor can display the chip set's 72-Hz vertical refresh rate and has all the controls located on the front, including horizontal- and vertical-position dials.

THOUGHTFUL DESIGN

Using a lift-out power supply/drive bay module, the Amkly 486/33E contains one accessible 3.5-inch vertical drive bay, two accessible 5.25-inch horizontal drive bays, and one 3.5-inch storage bay, which is internal.

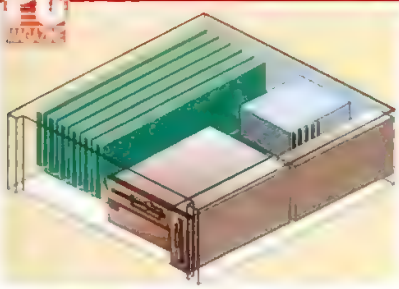
Though the IDE hard disk managed to stay in the top half of the disk benchmark test scores, the storage space may prove inadequate for file-server applications. But individual business users should find the space sufficient and will appreciate the lift-out module. One large DIN-style connector fits the system board to the module and keeps all expansion slots free of cables and wires. You will not find a loose screw or missing bolt anywhere. Amkly has wisely outfitted the PC with two fans so that future upgrades won't feel the heat.

Amkly Systems makes configuring the Amkly 486/33E extremely easy. A customized version of *HyperPAD* is installed and includes directions on how to optimize bus-mastered EISA boards. It also details menu options covering system setup, an on-line DOS manual, a system manual, and diagnostics. A flash EEPROM (electrically erasable programmable ROM) Phoenix BIOS facilitates upgrades and includes password protection, boot sequence parameters, and a screen saver.

The only important option missing from this list is the ability to disable the video and BIOS shadowing. If memory conflicts ever do arise, this may be a handicap.

Amkly has quickly brought its service and warranty coverage up to current standards. A one-year parts-and-labor warranty includes free on-site service and a 30-day money-back guarantee. Amkly addresses users' questions via a BBS, an automated fax service, and a toll-free technical support line that runs 24 hours, seven days a week. The Amkly 486/33E is a well-built desktop PC appropriate for individual users, and it is sold directly to users and through VARs. If you can locate an Amkly retailer, however, the company says you may find prices in the vicinity of $5,500.

FACT FILE



Amkly 486/33E
Amkly Systems Inc., 60 Technology Dr., Irvine, CA 92718; 800-367-2655, 714-727-0788.
List price (tested configuration): $6,950.
Memory and processor RAM cache: 8MB 70-ns. SIMMs.
Disk drives and controller: Seagate 18-ms. 210MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Trident 1,024-by-768 adapter with 1MB RAM, Amkly 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0.

CIRCLE 483 ON READER SERVICE CARD

AUSTIN COMPUTER SYSTEMS INC.

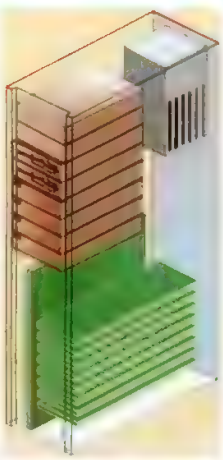
Austin 486-33E Wintower

by Winn L. Rosch■The cavernous tower case on the $4,482 Austin 486-33E Wintower dwarfs the EISA system board inside, but all that extra space inside the chassis means generous room—for expansion, air circulation, and cooling.

The all-steel, full-size tower case stands 24 by 7.5 by 22.5 inches (HWD) and leaves more than enough room inside for cards and drives. Two fans—one in the 300-watt power supply and one at the bottom of the front panel—provide fine cooling. An interior subchassis holds the 330MB unit we tested and eight rail-mounted 5.25-inch half-height drives. Of the eight full-size EISA expansion slots in the tested machine, six are usable.

Interior componentry is mostly off the shelf and consists of a pure Intel system board, from the chip set to the manufacturing. The 33-MHz 486, hidden under a huge heat sink, is enhanced by a two-way set-associative, 128K write-through cache based on Intel's own 82485 controller (a $499 option in the base-priced $2,590 Wintower model but included in all enhanced units). This combination yielded top-notch processor and memory test scores. Eight sockets on the system board hold most common-capacity SIMMs; if

FACT FILE



Austin 486-33E Wintower
Austin Computer Systems Inc., 10300 Metric Blvd., Austin, TX 78758; 800-752-1577.
List price (tested configuration): $4,482.
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 128K cache.
Disk drives and controller: Seagate 14-ms. 330MB SCSI hard disk, UltraStor controller, 1.2MB and 1.44MB floppy disk drives.
Display: Mylex 1,024-by-768 adapter with 1MB RAM, Sampo 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 484 ON READER SERVICE CARD

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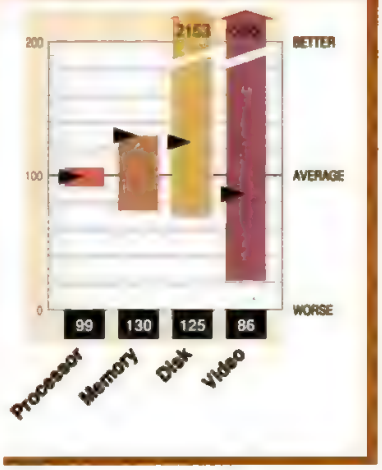
CIRCLE 377 ON READER SERVICE CARD

Austin 486-33E Wintower

TEST RESULTS



In Short: Big on speed and expansion, and fastest at memory access, the Austin 486-33E Wintower offers enough expansion for the biggest network. It has eight EISA slots (six available) and eight half-height 5.25-inch drive bays (five available), along with an Actix S3 accelerator for Microsoft Windows 3.0. This well-crafted system offers all this for under $5,000, which is a competitive price for such a plethora of features.

you start with four 2MB modules (as our test unit did), you will have to throw them out to reach the system's capacity of 64MB. All system board circuitry except the microprocessor and Phoenix ROM BIOS chips is surface-mounted and fills the entire 12- by 12.5-inch system board.

A two-drive floppy disk controller, two parallel ports, and two serial ports are included in the system board circuitry. The hard disk controller (an EISA-based UltraStor Ultra 24F noncaching SCSI host adapter in the evaluation unit) and accelerated display board (a Mylex GLI-911 capable of up to 1,280-by-1,024 noninterlaced resolution) fill two of the system's EISA slots, leaving six free for further expansion. Austin also included a 14-inch Sampo monitor whose vertical refresh rate is 72 Hz at Super VGA resolution, but the monitor does not support a 1,280-by-1,024 resolution. Standard equipment includes one 1.2MB or 1.44MB floppy disk drive; a second floppy disk drive costs $79. In addition, a 200MB hard disk is available; with that disk, the system sells for $3,657.

Austin puts the power switch and a combination keyboard lock and keyed reset switch on the front of the system. The keyboard connector (PS/2-style), all I/O ports, and the power connectors (including a switched outlet for a monitor) are relegated to the rear panel.

The Wintower comes with a one-year parts-and-labor warranty and on-site service by GE Computer Services, which has over 250 locations in the U.S. A toll-free technical help line operates from 7:00 A.M. to 10:00 P.M. E.S.T.

The Austin 486-33E Wintower's sub-$4,500 price is tough to beat. This unit is fully up to the challenge, with more than enough EISA and drive expandability for any present or future needs.

AUSTIN COMPUTER SYSTEMS INC.

Austin 486-33i Winstation

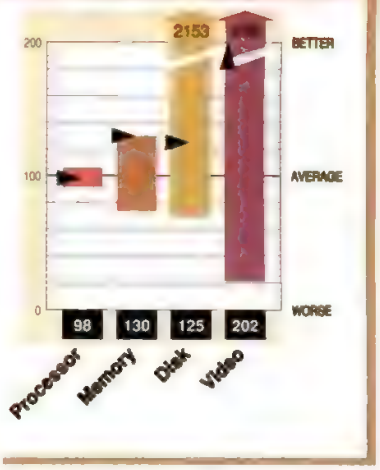
by Winn L. Rosch ■ Austin Computer Systems' new Austin 486-33i Winstation is a compact, high-performance package with surprising expansion capabilities and very good performance in memory and video writing. Best of all, a $2,695 list price for our tested configuration puts it at the lower reaches of the pricing spectrum.

Despite its small-footprint case (6.5 by 16 by 16.5 inches), the Winstation holds three 5.25-inch floppy disk drives (front-accessible half-heights) and an internal 3.5-inch hard disk bay. Of the seven AT-size expansion slots on the system board, only one is 8-bit (a short slot), and the rest are 16-bit ISAs. In the evaluation machine, one slot held a fast Diamond Turbo video board; the remaining slots were vacant.

The monitor Austin supplied, a 14-inch noninterlaced Relisys RE1520, can provide 1,024-by-768 resolution and a 72-Hz vertical refresh rate when running Super VGA. The Diamond Turbo video card had a Tseng ET4000AX chip set and could hold from 256K to 1MB video RAM. The controller's refresh rate was 70 Hz at 640-by-480 resolution, 72 Hz at 800-by-600, and 60 Hz at 1,024-by-768.

Austin 486-33i Winstation

TEST RESULTS



In Short: With six full-size ISA expansion slots and one 8-bit slot, three half-height 5.25-inch drive bays, and an internal 3.5-inch bay, the Austin 486-33i Winstation packs a lot of storage into a small-footprint package. This unit delivers top memory speed and excellent video abilities. While its chassis design shows some weakness, this PC's astoundingly low price and on-site service policy more than make up for such shortcomings.

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CIRCLE 353 ON READER SERVICE CARD

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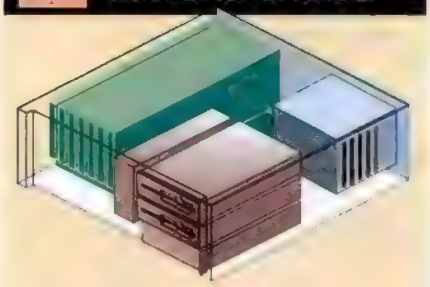


Austin 486-33i Winstation
Austin Computer Systems Inc., 10300 Metric Blvd., Austin, TX 78758; 800-752-1577.
List price (tested configuration): $2,695.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 128K cache.
Disk drives and controller: Western Digital 14-ms. 210MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Relysis 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 485 ON READER SERVICE CARD

The Austin-made system board holds all I/O functions except video: one parallel port, two serial ports, a port for a floppy disk drive, and an IDE hard disk connection. Jumpers on the system board allow each system board I/O function to be defeated.

Adjacent to the 33-MHz 486 processor is a socket for a Weitek 4167 coprocessor. A 128K secondary RAM cache, whose controller is built into the system's OPTi chip set, put performance in the middle of a tight pack.

Eight SIMM sockets hold the Winstation's memory, from the 4MB standard endowment (in 1MB modules) all the way up to 32MB (eight 4MB modules). Memory speed headed the list with a score identical to that of the system's sibling, the Austin 486-33E Wintower. The Winstation's disk should have benefited from the tested unit's 64K multisegmented adaptive cache built into the Western Digital Piranha 4200 hard disk (a 210MB unit rated at 14 milliseconds), but the cache did not seem to affect the PC's disk test score.

The Winstation's biggest weakness is its chassis, a moderately heavy bright steel assembly that is nevertheless a bit too flexible once the case cover is removed. In addition, the reset button on the front panel is vulnerable to accidental operation.

Once you slide on the case cover, however, the Winstation is solid and attractive. Workmanship is good, as evidenced by the austere inside; only a few ribbon cables for I/O connections and the four power connections from the 200-watt dual-voltage power supply fill the interior space. The Winstation is protected by a one-year parts-and-labor warranty; GE Computer Services handles on-site service. A toll-free help line, operating from 7:00 A.M. to 10:00 P.M. E.S.T., will help you through any teething pains.

The Austin 486-33i Winstation packs a lot of performance and expansion into a compact package. It is an attractive, aggressive, and affordable system.

COMPAQ COMPUTER CORP.

Compaq Deskpro 486/33M

by Alfred Poor ■ The "M" in Compaq Deskpro 486/33M stands for *modular*. As the flagship of this EISA-based family, the Deskpro 486/33M carries a fairly high list price of $7,401. And that's with a 120MB hard disk; a 210MB hard disk would bring the system price up to $9,000. Yet this price point marks Compaq's entry into more moderate territory.

Since the Deskpro 486/33M's performance figures were close to those of other machines in this review, a purchase decision will be based on features besides its speed on our tests. And there are plenty of features—both good and bad—to influence your final choice.

The first and most obvious feature is the case. While most mail-order houses place 486s into the largest tower cases available, Compaq has chosen a more modest wrapper for this system. The small-footprint desktop case is just 17 inches wide but has a typical 6-inch height.

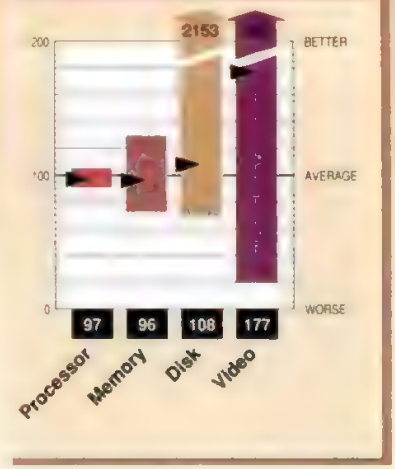
Ample expansion options still allow room for three front-accessible 5.25-inch half-height floppy disk drives and another internal one. The motherboard contains four full-size EISA slots; another EISA slot supports a screen-blanking security feature. The remaining two slots are proprietary designs for high-speed 32-bit system memory (64MB maximum) and the CPU card. With I/O ports and the floppy/hard disk controller integrated on the motherboard, all four slots remained open in our tested configuration.

Compaq offers other machines in the Deskpro/M line; these differ primarily in their CPUs, which reside on a proprietary card. Upgrading is as simple as pulling one card and replacing it with another. Though the Deskpro 486/33M is the top of the line, Compaq also sells the same system with 486SX/25, 486SX/16, and 386/25 CPU cards.

Other attractive features include security: password support in ROM, boot control, keyboard password lockout,

Compaq Deskpro 486/33M

TEST RESULTS



In Short: The $7,401 Compaq Deskpro 486/33M is a modular EISA unit in a compact case but with a full-size price. It has few compelling features, though its Super VGA video subsystem turned in a fine benchmark test time. If discounts bring its price within the range of competing machines, its solid and versatile design is worth your consideration.

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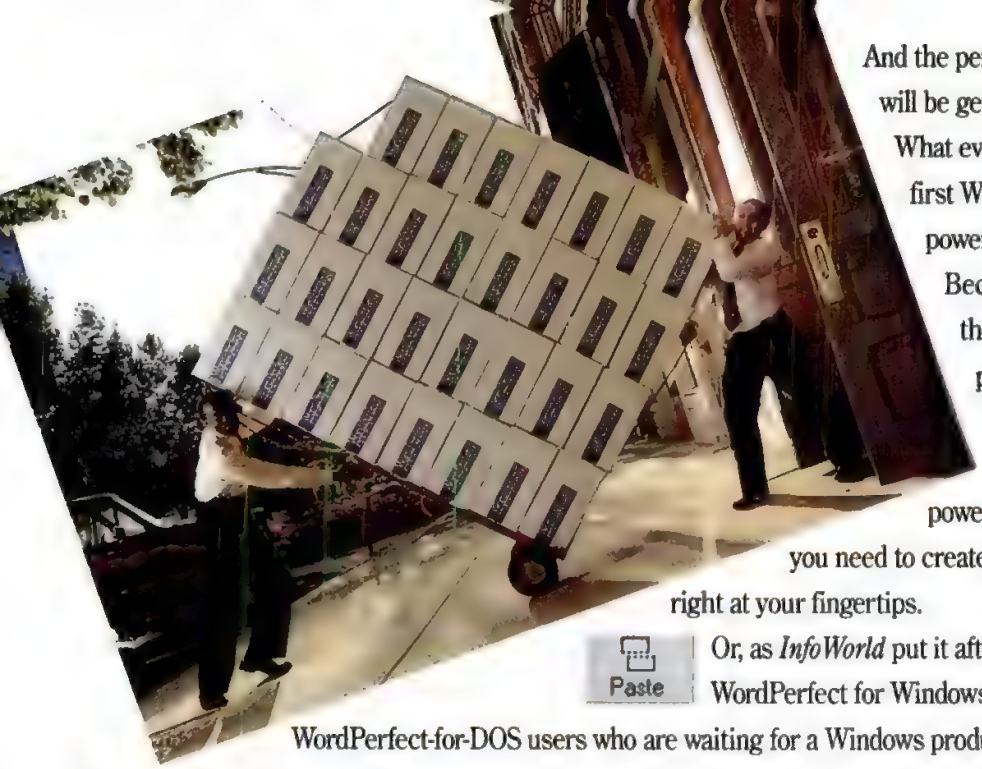
Styles

It also looks like the 7,000 people who entered our contest to predict first month's orders of WordPerfect for Windows knew what they were talking about. Even though the average of all the estimates, 640,955, still seems high, it's starting to look more realistic.



And the person whose estimate comes closest will be getting the $25,000 prize.

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CORPORATION

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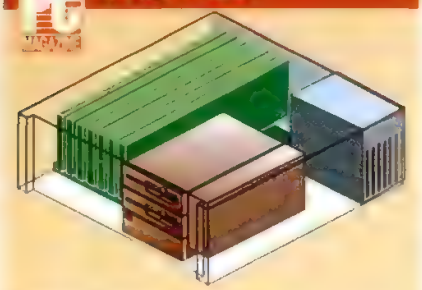

Compaq Deskpro 486/33M
Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; 800-231-0900, 713-370-0670.
List price (tested configuration): $7,401.
Memory and processor RAM cache: 8MB 80-ns. SIMMs.
Disk drives and controller: Conner 19-ms. 120MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Compaq VGA adapter with 512K RAM, Compaq 14-inch monitor.
Monitor refresh rate: 70 Hz.
Software: DOS 5.0.

CIRCLE 483 ON READER SERVICE CARD

screen blanking with password, I/O-port access, and floppy disk drive access control for both booting and file operations. The standard video controller with the system supports 16-color Super VGA resolutions. In addition, Compaq offers a wide range of hard disks, tape drives, and other expansion options.

On the other hand, certain drawbacks offset some of the attractions. There is no external system cache for the 486 processor, even as an extra-cost option. The color monitor supplied for evaluation was VGA-only and could not support the higher Super VGA resolution. A third drawback is the list price, which places the Deskpro 486/33M at about twice the cost of many competing systems.

If you do choose this system, you will have on-site service options. Compaq has approved GE Computer Services, Intelogic Trace, and TRW as authorized on-site service providers. Though Compaq does not sell the contract itself, authorized dealers can sell customers a service policy with any one of these third-party service providers. TRW has offered a yearly rate of $39 for sites with 100 or more Deskpros.

There has been a lot of talk recently about the changes at Compaq and the company's move toward leaner designs and more competitive pricing. Yet this system has no compelling performance or technological advantage. It is likely that your decision will be affected largely by the size of the discount you can get off the list price. If the price comes close to your alternative choices, you should consider the Compaq Deskpro 486/33M as a compact and well-built selection.

COMPUADD CORP.

CompuAdd 433E Tower

by Edward Perratore ■ Rooted in mail-order sales, CompuAdd Corp. has branched out to more than a hundred retail stores. The company's attention to its systems' ease of use is one reason behind its success. Once you get beyond the CompuAdd 433E Tower's comprehensive, well-written documentation, you will find within this EISA PC a selection of mostly brand-name components.

Integrated onto the motherboard are one parallel and two serial ports, a Weitek 4167 socket, and an IDE hard disk interface. Our $5,095 test system used a SCSI adapter to run the 330MB Seagate hard disk, though a 200MB option is available for $1,000 less. If you are running the system as a file server, you may want to choose an EISA controller.

Eight standard EISA slots line the motherboard, with one exception. If you use CompuAdd's 16-bit Hi-Rez VGA adapter (a repackaged version of Tseng's Viewtop ET-4000), the special slot to the left of the standard slots will run the board at 12.5 MHz instead of the usual 8-MHz bus speed. Despite the presence of this card, the CompuAdd 433E Tower showed no significant performance gains. Nor will the company guarantee you any performance gains if you use another board—even an ET-4000–based card purchased elsewhere.

EXPANDABLE NOT UPGRADABLE

Where the 433E Tower truly excels is in drive capacity, which is helpful when you are also using the SCSI adapter board for other drives such as CD-ROM and tape backup. The 433E Tower has nine 5.25-inch drive bays (two hold the standard 1.2MB and 1.44MB high-density floppy disk drives). Its 300-watt power supply comes with enough connectors (and wattage) to support all. True, those interested in an upgradable server cannot upgrade the CPU, but while you can't go up in speed, you can pack plenty in the box.

Four of the 5.25-inch floppy disk drives are accessible through the 433E Tower's case. The power switch and keyboard lock are also in the front. You will not find a reset switch, however, and there is no turbo button for switching between 16 and 33 MHz. You will have to run the Phoenix BIOS's CMOS setup to switch clock speeds.

One disappointment initially marked our testing of the 433E Tower: CompuAdd neglected to include the 256K processor RAM cache that came with every other system tested in this roundup. As a result, the 433E Tower scored poorly on

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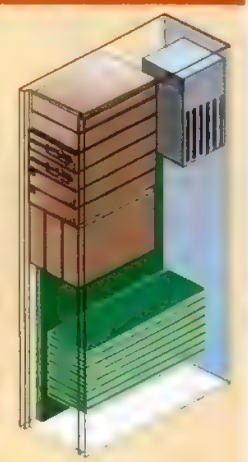

CompuAdd 433E Tower
CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727; 800-456-3116, 512-250-1489.
List price (tested configuration): $6,094.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Seagate 14-ms. 330MB SCSI hard disk, BusTek controller, 1.2MB and 1.44MB floppy disk drives.
Display: CompuAdd 1,024-by-768 adapter with 1MB RAM, Samsung 14-inch monitor.
Monitor refresh rate: 88 Hz (interlaced).
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 467 ON READER SERVICE CARD

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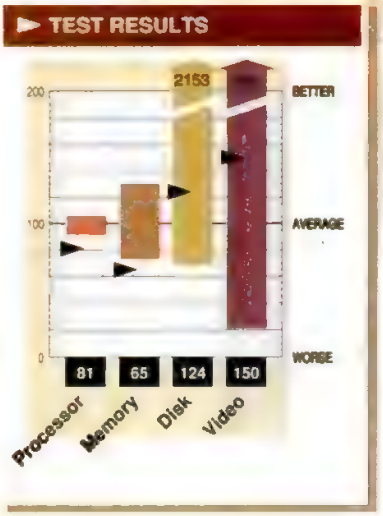
CompuAdd 433E Tower



In Short: Look at the CompuAdd 433E Tower if you want a system with top-notch documentation and proven service and support. Also, make sure the system you buy comes with a cache board. The test scores reflect the system's performance without this feature; when we installed the optional $999 card, the processor and memory performance improved dramatically.

PC Magazine Labs' processor and memory benchmark tests.

Late in this roundup's production cycle, however, we were able to receive and install this $999, typically factory-installed option—but not in time to update our chart of scores. With the static RAM cache installed, the CompuAdd 433E Tower took only 1.12 seconds to complete the processor test—a 17 percent improvement over the original Instruction Mix test score. On the memory test, the 433E Tower now landed a 0.17-second result—a 39 percent improvement.

Even if you don't choose this RAM cache option (although you probably should), CompuAdd provides plenty of cushion for buyers. In addition to a 30-day money-back guarantee and toll-free phone support, the system price includes a year of on-site service through Memorex Telex.

Combine these options with a strong power supply and ample room for expansion—a must if you are looking for a server—and you have a 486/33 that is surely worth considering.

DELL COMPUTER CORP.

Dell PowerLine 433DE

by Patrick Honan ■ With an EISA bus, a replaceable CPU design, and a ROM BIOS stored in easily upgradable Flash ROM, the Dell PowerLine 433DE has enough power to handle applications both today and in the future. At the same time, the PowerLine 433DE offers all the amenities users want in a standalone machine—including FCC Class B approval.

The PowerLine 433DE's technological goodies do not come cheap. At $6,047 for the reviewed configuration, the PowerLine 433DE is on the high side of moderate. Upgrades also come steep. Dell sells its 50-MHz 486 CPU board for $2,699, including a trade-in of the 33-MHz CPU board.

The 6- by 16- by 16-inch case takes up little desk space and offers adequate expandability. Six EISA slots accept 32-bit EISA boards or 8- and 16-bit ISA boards. The I/O ports, video, IDE interface, and floppy disk controller are integrated on the motherboard, which left all slots open in the tested machine. The CPU board, parallel to the sixth slot, prevents you from installing a full-length board here. The other slots accept full-length boards.

The PowerLine 433DE has three accessible 5.25-inch drive bays and one internal 3.5-inch drive bay. Although it is not a standard feature, you can mount a second internal bay next to the first with brackets that Dell supplies at no charge. But if you add this second internal bay, you won't be able to use two of the expansion slots. We would like to see one more accessible bay; such an arrangement would let you install two floppy disk drives, a tape drive, and a CD-ROM player—not an uncommon wish as more and more CD-ROM media become available.

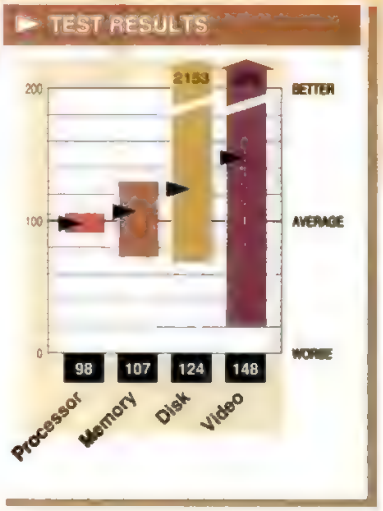
Dell packs the PowerLine 433DE with many of its own components. For example, Dell makes the motherboard and RAM cache controller; Dell and Intel jointly developed the chip set. System memory fits into six SIMM sockets on the motherboard. The tested machine came with 8MB of 80-nanosecond interleaved-page SIMMs, but you can add a maximum of 96MB using proprietary 16MB SIMMs.

The machine's ergonomic considerations are excellent. The power switch is on

the front panel, and large thumbscrews hold the cover to the chassis. A diagram of all internal components is pasted onto the drive bay and makes locating system parts a breeze.

Most standalone users probably won't get much advantage from the EISA bus, though EISA graphics controllers from a number of third-party manufacturers may improve the performance of CAD and other complex graphics applications. In addition, 32-bit EISA hard disk controllers may help you if you do image pro-

Dell PowerLine 433DE



In Short: The Dell PowerLine 433DE's upgradable CPU design and EISA bus deliver enough power for today and the future. Also, you can easily upgrade the BIOS, which is kept in Flash ROM. The machine has strong ergonomic features, and its construction is excellent. Key components, including the motherboard, RAM cache, and video, are made by Dell. Its benchmark test scores range from average to above average.

Seagate's SCSI Drives

THE FINE ART OF DISC DRIVES

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When it comes to the SCSI interface, no one has a more complete palette of disc drives than Seagate.

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Seagate

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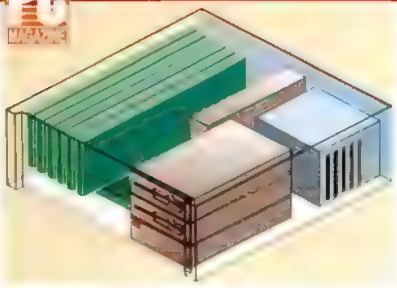


Dell PowerLine 433DE
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355.
List price (tested configuration): $6,046.90.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Maxtor 15-ms. 202MB IDE hard disk, 1.2MB and 1.44MB floppy disk drive.
Display: Dell 1,024-by-768 adapter with 1MB RAM, Arche 14-inch monitor.
Monitor refresh rate: 86.9 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 480 ON READER SERVICE CARD

cessing or other types of work that involve very large files, or if you use the PowerLine 433DE as a server for small groups.

Dell backs the machine with a one-year parts-and-labor warranty and provides free on-site service from Xerox for the first year. Toll-free technical support is available weekdays from 7:00 A.M. to 10:00 P.M. E.S.T. and Saturdays from 9:00 to 5:00.

At a time when purse strings are tight and hardware prices plummeting, many users will understandably find it hard to opt for the PowerLine 433DE. After all, you can buy two 33-MHz 486 systems from some other manufacturers for about the same cost. With the Dell PowerLine 433DE, you pay more up front than for some other systems, but you get a system that will continue to give you a return on your investment years from now.

DTK COMPUTER INC.
DTK FEAT-3300

by Edward Perratore ■ DTK Computer prides itself on selling bare-bones systems made up primarily of this company's components. With a few notable exceptions, the DTK FEAT-3300 is worth its cost ($3,399 for the tested system). This ISA-bus tower is typically sold through distributors and resellers, but DTK is now marketing the system as its new Gràfika line of fully configured PCs.

Within the spacious tower case, you will find the vendor's own motherboard and ROM BIOS (DTK's motherboard is commonly retailed through other companies). SIMM banks hold a maximum of eight 1MB chips; another 8MB can go on an add-in board fitting into a proprietary slot. By the time you read this, the company expects to ship a newer motherboard with a 32MB capacity in its systems (without the add-in board).

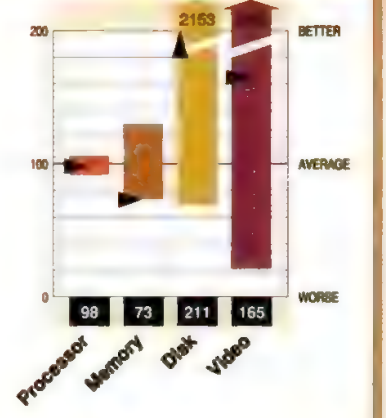
The FEAT-3000's setup routine includes a password (before boot and/or setup), disk parking, and the usual system setup. What it does not include is system or video BIOS shadowing. For users who desire the potential speed advantage that shadowing offers, DTK will sell the system with a slightly different BIOS that makes shadowing available.

One advantage of DTK's tower case is the number of drive bays. Beneath the front panel—containing turbo, reset, and power buttons, keyboard lock, and indicators—are three accessible 5.25-inch drive bays. Inside are two more half-height bays—plus room to attach a full-height or half-height drive to the crossbeam. The power supply is short one connector if you do wish to install six drives, but you can easily slip in a Y connector. The FEAT-3300's empty expansion slots number six after the Tseng Viewtop ET-4000 Super VGA video adapter and the combination I/O and IDE pass-through card are installed.

On our memory test, the FEAT scored somewhat poorly, but two other scores were far more significant. The 15-millisecond-rated Quantum hard disk scored second only to the Tangent 433e's SCSI

DTK FEAT-3300

TEST RESULTS



In Short: DTK Computer, which also sells components to other vendors, included mostly DTK-made parts in its DTK FEAT-3300. The system's fast video and IDE hard disk more than make up for its lackluster performance on our memory test. Support, typically available only through distributors and resellers, improves if you buy the system fully configured as part of the new Gràfika line.

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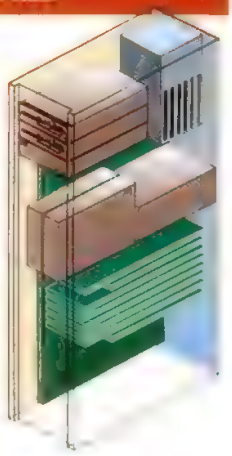

DTK FEAT-3300
DTK Computer Inc., 17700 Castleton St., #300, City of Industry, CA 91748; 818-810-8880.
List price (tested configuration): $3,399.
Memory and processor RAM cache: 8MB 20-ns. SIMMs.
Disk drives and controller: Quantum 15-ms. 240MB IDE hard disk, 1.2MB and 1.44MB floppy disk drive.
Display: Tseng 1,024-by-768 adapter with 1MB RAM, DTK 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0.

CIRCLE 483 ON READER SERVICE CARD

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caching controller. And the adapter/monitor combination ranked in the top third of the pack on PC Magazine Labs' video test.

Service during the one-year warranty is not usually handled through DTK but by the distributor or reseller who sold you the system (although you can call a regional office for free technical support). The reason is that DTK usually sells a bare-bones system (motherboard, case, and power supply) to the distributor, who then adds on whatever else is necessary.

If you are thinking of buying the bare-bones DTK FEAT-3300, consider also the preconfigured model selling under the Gràfika label. Besides having wider availability than you might otherwise find, these systems are sold with a toll-free support line and on-site service from GE Computer Services. Such extras make a good deal look even better.

ERGO COMPUTING INC.

Ergo Moby Brick 486DX

by Alfred Poor■Ergo Computing can get away with calling its 486/33 the terminally cute name Moby Brick because the thing really *is* cute. You won't be as easily delighted with the Ergo Moby Brick 486DX's price: $6,194 with a 120MB hard disk and $6,794 with a 212MB unit.

Even so, you must expect to pay a premium for a 486 desktop that fits inside your briefcase.

The Moby Brick comes in a compact 8.5-pound package the size of a 3.5-inch stack of paper—about the width of two modest-size phone directories. Ergo's trademark gray-on-gray paint job complements the high-tech contents: a 486 computer complete with room for 32MB of RAM, a hard disk, a high-density 1.44MB floppy disk drive, and high-resolution video.

The Moby Brick has no external system cache, but it produces performance figures in the same league as the rest of the machines in this review. Speed is only part of this machine's mission, though.

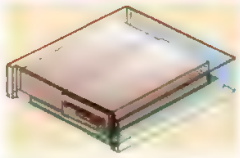
One look confirms that the Moby Brick is not destined to be a network server; this is a personal power tool to be carried around and plugged in wherever you need top-of-the-line computing power. And Ergo has gone for the gold in terms of the product's design. The video interface produces 1,024-by-768 noninterlaced high-resolution graphics, with the Edsun CEG available as a no-cost option. Ergo offers various monitors, but the tested 15-inch multifrequency monitor with digital controls was capable of a 72-Hz vertical refresh rate even at 1,024-by-768 resolution. In order to make it easier to take the computer with you, Ergo offers an optional keyboard that is only 15.5 inches wide yet still has all 101 keys. You also get DOS 5.0 with your choice of *DESQview* with *TREE 86* or Microsoft Windows 3.0 with ATM.

You might want to consider some options we did not test. The docking station lists for $395; it has video and I/O ports, as well as a 16-bit ISA slot, so you can hook up to a network with a $400 Ethernet and SCSI adapter. And you can get a $995 VGA monochrome LCD panel monitor if you choose (this includes a video controller).

There are many compromises, however. Neither of the two expansion slots is full-length: One is a 16-bit ISA, and incredibly, the other is only 8-bit. This seems under-engineered, but the space limitations of the design are severe.

The real question is why you would buy this PC. If you are going to be working in only two locations, you could almost buy two competing traditional desktop systems for the same amount of money. Or for a bit more you can get a laptop that will also run on batteries. As it is, the Ergo Moby Brick 486DX is likely to appeal to a relatively small segment of the market.

FACT FILE

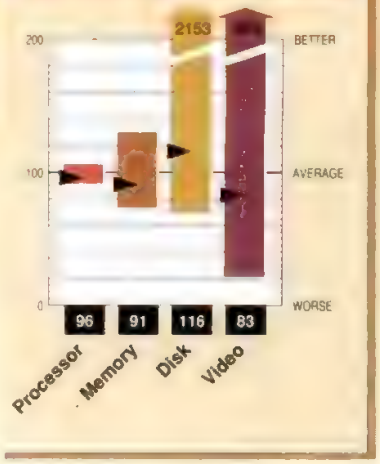


Ergo Moby Brick 486DX . Ergo Computing Inc., One Intercontinental Way, Peabody, MA 01960; 800-633-1925, 508-535-7510.
List price (tested configuration): $6,194.
Memory and processor RAM cache: 8MB 80-ns. SIPs.
Disk drives and controller: Conner 15-ms. 120MB IDE hard disk, 1.44MB floppy disk drive.
Display: Ergo 1,024-by-768 adapter with 1MB RAM, MAG Computronic 15-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 460 ON READER SERVICE CARD

Ergo Moby Brick 486DX

TEST RESULTS



In Short: The Ergo Moby Brick 486DX is an impressive exercise in squeezing a gallon of computer into a pint of case. But its high price and limited expansion will keep its appeal to the select few who can take advantage of its portable design. The PC's performance was somewhat below average in three of the four categories.

EVEREX SYSTEMS INC.

Everex STEP 486/33

by Henry Fersko-Weiss■From the intelligently planned front-panel controls to the small motherboards with well-integrated chip sets, good engineering and design are the hallmarks of Everex Systems' top-of-the-line 486-based STEP computers. Free on-site service from National Computer Service and a 48-hour

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turnaround policy under the one-year warranty add to the appeal of these products.

On the Everex STEP 486/33, the quality of the design shows up right at the front of its desktop case. The reset, speaker, and turbo buttons sit recessed behind a sliding plastic door that prevents accidents. In the same panel you find the typical LED indicators and an 8-character LED panel—a bit gimmicky perhaps, but useful for providing test messages and status information when troubleshooting.

On the front panel are five accessible 5.25-inch drive bays. Plentiful space behind the drive bays and alongside the power supply improves air circulation and makes it easy to reach all the device connectors. The motherboard only takes up about a third of the chassis width and is located away from the heat of the drives and power supply. You don't have to contend with wires or the drive housing to reach all its main components.

The 16 SIMM slots, which can hold up to 64MB of RAM, are particularly easy to reach, since they are on a 32-bit proprietary card in the first slot on the left. Only two other slots are occupied, one with the Everex Viewpoint NI Super VGA card and the other with Everex's ESDI hard disk controller. This leaves open four 16-bit slots and one 8-bit slot.

On our test unit, however, the NI Viewpoint video card with 512K of video RAM offered a top resolution of 1,024 by 768 pixels, noninterlaced, while the monitor's maximum resolution was Super VGA (800 by 600 pixels). The refresh rate at the maximum resolution was 60 Hz. A Tseng chip set helped account for the top-notch video score.

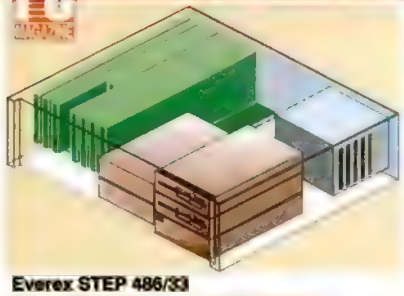
When it comes to performance, the ISA-based 486/33 attained the top score on PC Magazine Labs' processor and video tests and tied for second on the memory test. One of the reasons for this fine performance may be the STEP 486/33's 256K direct-mapped write-back cache. On the other hand, its time on the disk test was comparatively poor for this group.

Since the STEP series is upgradable, you can move from a 386 up to a 486 processor by changing a card on the motherboard. The design does not allow for upgrades to 50 MHz. Nevertheless, the system is quite versatile. Everex sells hard disk controllers of every kind, as well as a wide range of hard disks, from a 20MB MFM to a 1.6GB SCSI. For $1,500 more, a special cube chassis holds 12 expansion slots, 8 half-height drive bays, and a 400-watt power supply.

Everex lets you extend the one-year warranty for up to two more years at a cost of $500 per year. Technical support is not toll free, but the hours are long: 9:00 A.M. to 10:00 P.M. E.S.T.

The Everex STEP 486/33 makes for a very good file server or graphics workstation. It boasts top-tier performance, solid design, and wonderful flexibility in configuration options.

FACT FILE

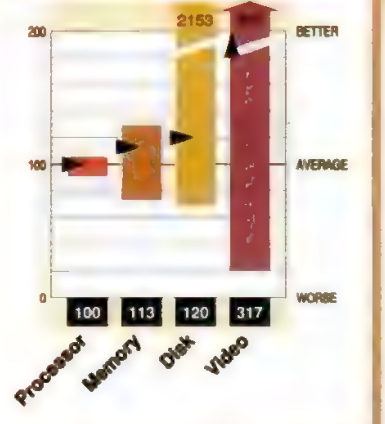


Everex STEP 486/33
Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-821-0806, 510-498-1111.
List price (tested configuration): $7,531.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Maxtor 15-ms. 213MB ESDI hard disk, Everex controller, 1.2MB and 1.44MB floppy disk drives.
Display: Everex 1,024-by-768 adapter with 512K RAM, Everex 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 492 ON READER SERVICE CARD

Everex STEP 486/33

TEST RESULTS



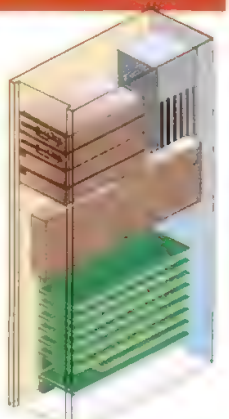
In Short: The Everex STEP 486/33 had the best score on the video test, and it tied for second on the memory test. This system's direct-mapped write-back cache helped boost its processor and memory scores; a Tseng chip–based card gave the STEP 486/33 its video speed. Its disk score was better than average.

EVEREX SYSTEMS INC.

Everex STEP 486/33e

by Henry Fersko-Weiss ■ Take your pick. Whether you cast Everex Systems' $8,231 EISA tower, the Everex STEP 486/33e, as a high-end file server or as a graphics workstation, it performs either role admi-

FACT FILE



Everex STEP 486/33e
Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-821-0806, 510-498-1111.
List price (tested configuration): $8,231.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms. 213MB ESDI hard disk, Everex controller, 1.2MB and 1.44MB floppy disk drives.
Display: Everex 1,024-by-768 adapter with 512K RAM, Everex 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 491 ON READER SERVICE CARD

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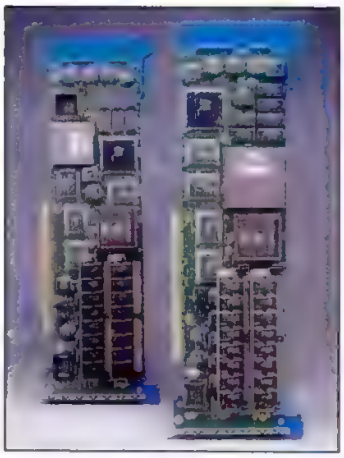

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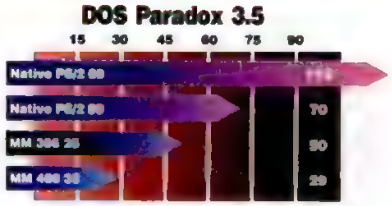

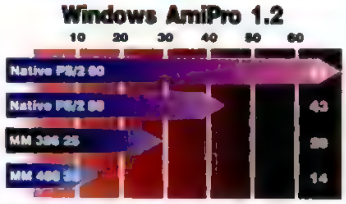

Benchmarks shown in these charts are based on real world applications, taking into account CPU, memory, disk, and video performance. Smaller numbers indicate higher performance.

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CIRCLE 032 ON READER SERVICE CARD

rably. The STEP 486/33e offers virtually the same expansion capabilities, flexible configuration, and service as its ISA-based desktop counterpart, the Everex STEP 486/33e. Priced $700 higher, however, the STEP 486/33e gives you 32-bit expansion slots and EISA bus mastering.

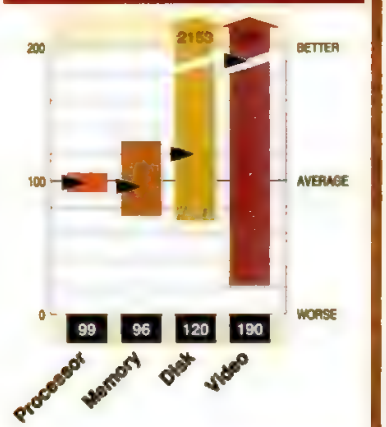
The STEP 486/33e comes in a stylish battleship-gray metal case with a charcoal-gray plastic faceplate. It is available in other chassis types, including a cube that holds 12 expansion slots, 8 half-height drive bays, and a 400-watt power supply, for $1,500 more.

A control panel at the top front holds the power, reset, speaker, and speed switches, as well as the useful eight-character LED panel for troubleshooting information. The control panel protrudes from the top of the tower and is tilted inward at the top to protect the switches, but you could still hit them accidentally. South of the control panel you will find four accessible 5.25-inch drive bays. A handle at the tower's back makes moving the system easier.

The tower opens easily: Remove three screws and slide the left side panel off.

Everex STEP 486/33e

TEST RESULTS



In Short: The Everex STEP 486/33e scored well on our benchmark tests, but it was slightly slower than the STEP 486/33 even though both use a direct-mapped write-back cache. This EISA model has six 32-bit expansion slots and six 5.25-inch drive bays, though an optional cube chassis can give it more.

33-MHz 486-BASED PCs: SUMMARY OF FEATURES

List price (*PC Magazine* configuration) For this review of 33-MHz 486-based computers, we requested a standard configuration that included 8MB of RAM, a 200MB hard disk, two floppy disk drives, a Super VGA color display subsystem, one parallel and two serial ports, and DOS 5.0. All 24 PCs reviewed provide a reasonably close match to these requirements.

The *PC Magazine* configuration price is followed by its **hard disk capacity.** Unless otherwise noted, all table entries refer to the options available in the systems reviewed.

Distribution channel Some machines are sold directly through mail order, others through dealers. Dealers have previously offered discounts of 25 percent or more off the list price; however, an industry-wide price restructuring has cut these discounts in many cases. *PC Magazine* views a 15 percent discount as typical.

Bus architecture The original IBM PC AT bus used the 16-bit Industry Standard Architecture (ISA). Extended Industry Standard Architecture (EISA) and Micro Channel architecture (MCA) allow 32-bit transfers.

Chip set manufacturer indicates which company makes the logic that connects the CPU with the other functions managed by the system board. Chip sets that use VLSI (very large-scale integration) technology reduce the discrete component count, which in turn helps reduce power consumption and increase component life.

System shadowing/Video shadowing Shadow RAM is a technology that loads system BIOS or video BIOS from slower ROM into faster RAM on boot-up, offering enhanced performance speed. Shadowing uses RAM located between 640K and 1MB.

The **BIOS version (or date)** can affect PC Magazine Labs' benchmark test results. Those purchasing the same-model machine with a different BIOS version may encounter some variations in performance.

Flash EEPROM An EEPROM (electrically erasable programmable ROM) chip contains BIOS code that can be updated via software. The BIOS is generally stored in conventional ROM, which has no provision for modification.

Installable RAM indicates the minimum and maximum amount of memory that can be installed using any combination of chips and proprietary cards.

Drive bays Accessible drive bays can be reached from the system's front panel and can support removable media (such as tape and CD-ROMs); internal drive bays can be reached only by opening the case. We report the maximum number of accessible and internal drives the system can hold.

Minimal floppy disk drive configuration indicates whether the vendor equips its base-priced system with a 1.2MB floppy disk drive, a 1.44MB floppy disk drive, or both.

Hard disk options We report the range of hard disk capacities the vendor offers.

Disk controller location A computer with IDE (integrated drive electronics) circuitry has its controller functions integrated into the drive and motherboard.

Expansion bus For each type of expansion slot—8-bit, 16-bit, 32-bit EISA/MCA, and 32-bit proprietary—we report the number of slots on the motherboard and the number of slots left open when the PC is equipped in our standard configuration.

Standard display mode refers to the resolution of the video card that comes in the tested configuration. For this review, we requested a Super VGA display (800 by 600 pixels), though we accepted 1,024-by-768 resolution as well.

The **display circuitry** can reside on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled, there is no way to upgrade it.

Number of device connectors indicates how many internal storage devices the power supply can support without requiring Y cables (power splitters).

DOS versions and prices are listed here. If no price is given, the vendor's least expensive configuration includes DOS. (*PC Magazine*'s configuration includes DOS 5.0—4.01 or 3.3 if 5.0 is not available — to allow more accurate price comparisons.)

Other bundled software is software that comes with the system at no extra charge. This category includes disk-caching software (such as SMARTDRV.SYS), expanded memory management software (such as *QEMM-386*), Microsoft Windows 3.0, and any applications the vendor supplies as extras.

FCC Class B identification number Systems with a Class B rating from the Federal Communications Commission can be purchased for home use and are not likely to interfere with radio and television reception. Public Access Link, the FCC's bulletin board service (301-725-1072), lists every Class B system by its FCC identification number.

CONTINUES

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Expandable to 32 MB
1.44 MB 3.5" Floppy Drive
60 MB IDE Hard Drive
1024 X 768 SVGA Adaptor
1 Parallel/2 Serial Ports
101 Keyboard

System 486D

Rent for $199*/$129**
(Rental fee toward purchase)
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Mid-size Tower Case
64K Cache Static RAM
2MB RAM Standard
Expandable to 32 MB
1.44 MB 3.5" Floppy Drive
60 MB IDE Hard Drive
1024 X 768 SVGA Adaptor
1 Parallel/2 Serial Ports
101 Keyboard

System 486E

Rent for $269*/$179**
(Rental fee toward purchase)
Intel 486DX/33
6 EISA Expansion Slots
Mid-size Tower Case
128K Cache Static RAM
2MB RAM Standard
Expandable to 32 MB
1.44 MB 3.5" Floppy Drive
60 MB IDE Hard Drive
1024 X 768 SVGA Adaptor
1 Parallel/2 Serial Ports
101 Keyboard

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14" SVGA Non-Interlaced	*$45*	*$30*
VGA Mono Display	*15*	*10*
5.25" Floppy Diskette Drive	*7*	*5*
2 MB RAM Upgrade	*15*	*10*
6 MB RAM Upgrade	*30*	*20*
14 MB RAM Upgrade	*65*	*45*
120 MB Hard Drive Upgrade	*22*	*15*
200 MB Hard Drive Upgrade	*45*	*30*
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33-MHz 486-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

■—Editors' Choice
■—Yes ❑—No

	ALR BusinessVEISA 486/33 Model 200	ALR PowerPro VM 486/33 Model 150	Amkly 486/33E	Austin 486-33E Wintower
List price (*PC Magazine* configuration)	$5,742	$10,222	$6,950	$4,482
Hard disk capacity	212MB	150MB	210MB	330MB
Distribution channel	Dealers	Dealers	Dealers	Direct
Case style type	Small-footprint	Tower	Small-footprint	Tower
Bus architecture	EISA	EISA	EISA	EISA
MOTHERBOARD				
Motherboard manufacturer	ALR	ALR	Amkly	Intel
Chip set manufacturer	Intel/ALR	ALR	Intel	Intel
System shadowing/Video shadowing	■/■	■/■	■/■	■/■
Upgradable processor	■	■	■	❑
BIOS version (or date)	Phoenix 4.03.03	Phoenix 4.03.03	Phoenix 1.00.02	Phoenix 1.10.33
Flash EEPROM	❑	❑	■	❑
Supports 80487/Weitek coprocessor	■	■	■	❑
MEMORY AND PROCESSOR RAM CACHE				
Installable RAM	1MB–49MB	5MB–49MB	4MB–112MB	8MB–64MB
Cache controller	Proprietary	Proprietary	None	Intel
Installable RAM cache	64K–256K	64K–256K	N/A	64K–128K
DISK DRIVES				
Accessible drive bays	Two 5.25-inch, one 3.5-inch	Three 5.25-inch, one 3.5-inch	Three 5.25-inch, no 3.5-inch	Six 5.25-inch, no 3.5-inch
Internal drive bays	1	None	1	2
Minimal floppy disk drive configuration	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
Hard disk options	80MB–1.2GB	150MB–1.2GB	120MB–340MB	330MB–1.6GB
Disk controller location	Integrated	Card	Integrated	Card
EXPANSION BUS				
8-bit slots	None	None	None	None
16-bit slots	2 (2 open)	2 (2 open)	None	None
32-bit EISA/MCA slots	4 (3 open)	8 (6 open)	6 (6 open)	8 (6 open)
32-bit proprietary slots	3 (1 open)	2 (none open)	1 (none open)	None
Parallel, serial, mouse ports on motherboard	1, 1, 1	2, 1, 1	2, 1, 1	2, 2, 0
VIDEO				
Standard display mode	Super VGA	Super VGA	1,024 x 768	1,024 x 768
Display circuitry location	Card	Card	Motherboard	Card
Video chip set manufacturer	Orchid	Orchid	Trident	Silicon Subsystems
POWER SUPPLY				
Power supply (watts)	145	300	200	300
Number of device connectors	4	4	4	7
SOFTWARE				
DOS	5.0	5.0	5.0	5.0
Other bundled software	ALR EISA system utilities	ALR EISA system utilities	None	Microsoft Windows 3.0
MISCELLANEOUS				
Warranty	1 year	1 year	1 year	1 year
First-year on-site service charge	Depends on system cost	Depends on system cost	Included	Included
FCC Class B identification number	E7YBV33486	E7YPWRP486DX-33	IFWAKREN48633E	HA7ACS433E-T

N/A — Not applicable: The product does not have this feature.

ALR — Advanced Logic Research Inc., AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., DTK—DTK Computer Inc., HP—Hewlett-Packard Co., VLSI—Very Large Scale Integrated Technology, TI—Texas Instruments Inc.

Austin 486-33i Winstation	Compaq Deskpro 486/33M	CompuAdd 433E Tower	Dell PowerLine 433DE	DTK FEAT-3300	Ergo Moby Brick 486DX	Everex STEP 486/33
$2,695 210MB	$9,000 200MB	$4,095 200MB	$6,046.90 202MB	$3,399 240MB	$6,794 200MB	$7,531 213MB
Direct Small-footprint ISA	Dealers Desktop EISA	Direct Tower EISA	Dealers, direct Small-footprint EISA	Dealers Tower ISA	Direct Small-footprint ISA	Dealers Desktop ISA
Austin OPTi ■/■ ❑ AMI (May 1991) ❑ ■	Compaq Compaq ■/■ ■ Compaq 08.14.91 ❑ ❑	CompuAdd Intel ■/■ ❑ Phoenix 1.10 ❑ ■	Dell Dell/Intel ■/■ ■ Phoenix/Dell 1.1 ■ ■	DTK Discrete logic ❑/❑ ❑ DTK 4.26 ■ ■	Ergo VLSI ■/■ ■ Ergo 2.09 ■ ❑	Everex Everex ■/■ ❑ AMI 1.10 ■ ■
4MB–32MB OPTi 128K	4MB–64MB None N/A	4MB–64MB Proprietary 256K	4MB–96MB Dell 128K	1MB–16MB Discrete logic 64K–256K	4MB–32MB None N/A	1MB–64MB Everex 128K–256K
Three 5.25-inch, no 3.5-inch 1 1.2MB, 1.44MB 40MB–426MB Integrated	Three 5.25-inch, no 3.5-inch 1 1.44MB 120MB–2.6GB Integrated	Four 5.25-inch, no 3.5-inch 5 1.2MB, 1.44MB 80MB–1.2GB Card	Three 5.25-inch, no 3.5-inch 1 1.2MB or 1.44MB 80MB–650MB Integrated	Three 5.25-inch, no 3.5-inch 3 1.2MB, 1.44MB 40MB–800MB Integrated	No 5.25-inch, one 3.5-inch 2 1.44MB 44MB–510MB Integrated	Five 5.25-inch, no 3.5-inch 2 1.2MB 20MB–1.6GB Card
1 (open) 6 (5 open) None None 2, 1, 0	None None 5 (5 open) 2 (2 open) 2, 1, 1	None None 8 (6 open) None 2, 1, 0	None None 6 (6 open) 1 (none open) 1, 2, 1	1 (open) 6 (4 open) None 1 (open) None	1 (open) 1 (open) None None 3, 1, 0	1 (none open) 6 (4 open) None 1 (none open) 2, 1, 0
1,024 x 768 Card Diamond	Super VGA Card Compaq	1,024 x 768 Card Tseng	1,024 x 768 Motherboard Western Digital	1,024 x 768 Card Tseng	1,024 x 768 Motherboard C&T	Super VGA Card Tseng
200 4	240 4	300 9	224 4	250 5	42 1	250 6
5.0 Microsoft Windows 3.0	5.0 Diagnostics	5.0 Microsoft Windows 3.0, Try-It	5.0 Microsoft Windows 3.0	5.0 Microsoft Windows 3.0	5.0 Adobe *ATM* or *DESQview 386* with *QEMM*, Microsoft Windows 3.0, *TREE 86*	5.0 Microsoft Windows 3.0
1 year Included HA7ACS433D-I	1 year Depends on dealer CNT75MBD7	1 year Included F2P-433T	1 year Included E2K433DE	1 year Depends on dealer F825K4FEAT3300	1 year 10% of system cost IPV1486-33E	1 year $80 E3EEX-2900D-L

CONTINUES

33-MHz 486-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

PC—Editors' Choice
■—Yes ❑—No

	Everex STEP 486/33e	Gateway 486/33C	GoldStar GS433	Hertz 486/33EI	HP Vectra 486/33T	IBM PS/2 Model 90 XP 486
List price (*PC Magazine* configuration)	$8,231	$3,045	$2,699	$6,980	$11,929	$10,150
Hard disk capacity	213MB	200MB	200MB	200MB	168MB	160MB
Distribution channel	Dealers	Direct	Dealers	Dealers	Dealers	Dealers
Case style type	Tower	Tower	Desktop	Tower	Tower	Desktop
Bus architecture	EISA	ISA	ISA	EISA	EISA	MCA
MOTHERBOARD						
Motherboard manufacturer	Everex	Micronics	Goldstar	Intel	HP	IBM
Chip set manufacturer	Intel	Micronics	VLSI	Intel	HP	IBM
System shadowing/Video shadowing	■/■	■/■	■/■	■/■	■/■	■/■
Upgradable processor	❑	❑	❑	❑	❑	■
BIOS version (or date)	Everex/Ami (August 1991)	Phoenix 0.10.G17-2	Quadtel 3.0	Phoenix 1.10.33 K1	HP K.03.02	IBM 1.02
Flash EEPROM	❑	❑	■	❑	❑	❑
Supports 80487/Weitek coprocessor	■	■	❑	■	■	■
MEMORY AND PROCESSOR RAM CACHE						
Installable RAM	1MB–64MB	4MB–64MB	4MB–32MB	4MB–64MB	4MB–64MB	8MB–64MB
Cache controller	Intel	Micronics	None	Intel	HP	IBM
Installable RAM cache	256K	64K	N/A	128K	128K	256K
DISK DRIVES						
Accessible drive bays	Four 5.25-inch, no 3.5-inch	Four 5.25-inch, two 3.5-inch	Three 5.25-inch, one 3.5-inch	Four 5.25-inch, no 3.5-inch	Six 5.25-inch, no 3.5-inch	One 5.25-inch, one 3.5-inch
Internal drive bays	2	2	1	4	None	4
Minimal floppy disk drive configuration	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB or 1.44MB	1.44MB	1.44MB
Hard disk options	20MB–1.6GB	40MB–1.2GB	40MB–200MB	52MB–2GB	84MB–1GB	80MB–400MB
Disk controller location	Card	Integrated	Integrated	Card	Integrated	Card
EXPANSION BUS						
8-bit slots	1 (open)	None	None	None	None	None
16-bit slots	None	8 (6 open)	7 (5 open)	None	None	None
32-bit EISA/MCA slots	6 (3 open)	None	None	10 (8 open)	8 (8 open)	4 (3 open)
32-bit proprietary slots	1 (none open)	None	1 (open)	None	4 (none open)	3 (1 open)
Parallel, serial, mouse ports on motherboard	None	None	None	2, 2, 1	None	2, 2, 1
VIDEO						
Standard display mode	Super VGA	1,024 x 768	1,024 x 768	1,024 x 768	Super VGA	XGA
Display circuitry location	Card	Card	Card	Card	Card	Motherboard
Video chip set manufacturer	Tseng	Tseng	Trident	Diamond	HP	IBM
POWER SUPPLY						
Power supply (watts)	250	200	200	396	360	194
Number of device connectors	6	6	3	6	6	5
SOFTWARE						
DOS	5.0	5.0	5.0	5.0	5.0 ($119)	5.0
Other bundled software	Microsoft Windows 3.0	Microsoft Windows 3.0	None	None	None	None
MISCELLANEOUS						
Warranty	1 year	1 year	1 year	1 year	1 year	1 year
First-year on-site service charge	$80	Included	Included	10% of system cost	Included	Depends on dealer
FCC Class B identification number	E3EEX-2900D-LE	HWY M486-33	ESQFTNB486-33P	EJM 486 S403	None	ANO859OA

ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., DTK—DTK Computer Inc., HP—Hewlett-Packard Co., VLSI—Very Large Scale Integrated Technology, TI—Texas Instruments Inc.

33-MHz-BASED PCs

Northgate Power Plus 486 ZXP	Tangent 433e	Tangent 433i	Tri-Star Flash Cache 486 EISA	Twinhead Superset 600/433C	Zenith Z-486/33E	Zeos 486-33
$3,899 212MB	$4,995 210MB	$3,183 210MB	$3,795 210MB	$4,279 200MB	$10,997 200MB	$3,545 210MB
Direct Tower ISA	Direct Tower EISA	Direct Mini-tower ISA	Direct Tower EISA	Dealers Small-footprint ISA	Dealers Small-footprint EISA	Direct Tower ISA
Northgate OPTi ■/■ ■ Northgate 6.07 ❑ ■	Mylex Intel ■/■ ❑ Mylex 6.04 ❑ ■	Dash OPTi ■/■ ❑ AMI (March 1991) ❑ ■	Free Intel ■/■ ❑ Award 15410005 ❑ ■	Twinhead Intel ■/■ ■ Award 3.0 ❑ ■	Zenith Intel ■/■ ❑ Zenith 3.7F ■ ■	Zeos VLSI ■/■ ■ Award 3.10 ❑ ❑
4MB–32MB OPTi 64K	1MB–32MB Mylex 128K	1MB–64MB OPTi 64K–256K	4MB–64MB Free Technology 256K	4MB–32MB Twinhead 64K	4MB–64MB None N/A	8MB–32MB Intel 128K
Three 5.25-inch, no 3.5-inch 4 1.2MB, 1.44MB 52MB–1.2GB Integrated	Six 5.25-inch, no 3.5-inch None 1.2MB 52MB–1.6GB Card	Three 5.25-inch, no 3.5-inch 2 1.2MB 52MB–1.6GB Integrated	Four 5.25-inch, no 3.5-inch 4 1.2MB, 1.44MB 40MB–1.2GB Card	One 5.25-inch, two 3.5-inch 1 1.2MB 100MB–500MB Integrated	One 5.25-inch, two 3.5-inch None 1.44MB 200MB–400MB Integrated	Four 5.25-inch, no 3.5-inch 5 1.2MB, 1.44MB 42MB–1.16GB Integrated
None 8 (7 open) None None 2, 1, 0	None None 8 (5 open) None None	None 8 (5 open) None None None	None 2 (none open) 6 (5 open) None None	None 4 (4 open) None None 2, 1, 0	None None 5 (3 open) None 2, 1, 0	1 (open) 7 (6 open) None None 2, 1, 0
1,024 x 768 Card S3	1,024 x 768 Card S3	1,024 x 768 Card S3	1,024 x 768 Card Tseng/Sierra	1,024 x 768 Motherboard Trident	TIGA Card TI	1,024 x 768 Card Tseng
220 7	300 4	300 6	230 4	165 4	200 3	300 4
5.0 Microsoft Windows 3.0, *QA Plus* 4.2	5.0 None	5.0 None	5.0 Microsoft Windows 3.0	5.0 LIM 4.0, Microsoft Windows 3.0	5.0 Microsoft Windows 3.0	5.0 *Ami Pro, Lotus 1-2-3 for Windows,* Microsoft Windows 3.0
1 year Included GT6486I3CT	1 year 10% of system cost None	1 year Included II74433I	2 years Included JASTS486-33ET	1 year Included FKGSS-600-433	1 year $80 IFO-GAZELLE	1 year $49 BYDPCT48633NT

ENDS

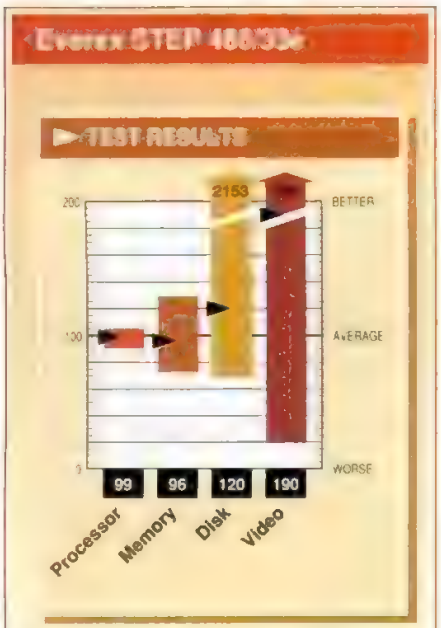
Inside, the STEP 486/33e is spacious and uncluttered. Four front-accessible drive bays and the power supply occupy the top part of the case. All the connectors are easy to reach. Just below them is a drive frame that can hold either two half-height or two full-height drives. The drive frame also serves as a brace across the middle of the computer, giving the chassis better support. The motherboard in this model is larger than in the STEP 486/33, and the drive frame covers about a third of the motherboard. All the important components, however, are easily accessible.

Six 32-bit EISA slots maximize the advantage of the STEP 486/33e's 32-bit data path. In the tested unit, a port controller, an ESDI controller for the 200MB hard disk, and Viewpoint NI video card occupied three slots. Our unit also held an 8-bit ISA and a proprietary 32-bit memory board slot. As in the ISA version, the STEP 486/33e's motherboard holds up to 64MB of RAM; it comes standard with a 256K RAM cache.

The EISA machine was slightly but not significantly slower than its ISA counterpart on the processor and memory tests. The STEP 486/33e's video result was markedly slower than the ISA-based version's but was still one of the top five scores. Everex had no explanation for this. Once again, the Maxtor ESDI hard disk's test time was unremarkable. You can use an EISA hard disk controller to improve performance under certain operations (for an extra $460).

Everex offers free on-site service from National Computer Service; you can extend it beyond the one-year warranty. Other attractive options are a 48-hour turnaround policy and long technical support hours: 9:00 A.M. to 10:00 P.M. E.S.T. (though the call itself is not toll-free).

The Everex STEP 486/33e has the same high quality of design and performance as its ISA cousin, the Everex STEP 486/33. What the STEP 486/33e offers beyond the ISA version is the ability to handle EISA peripherals, as well as better throughput in extremely demanding applications. If you know you want EISA compatibility, it's probably worth spending the extra bit more.



In Short: The Everex STEP 486/33e scored well on our benchmark tests, but it was slightly slower than the STEP 486/33 even though both use a direct-mapped write-back cache. This EISA model has six 32-bit expansion slots and six 5.25-inch drive bays, though an optional cube chassis can give it more.

GATEWAY 2000
Gateway 486/33C

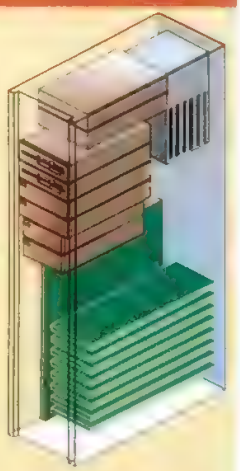
by Patrick Honan ■ Gateway 2000's Gateway 486/33C tower goes straight to the heart of corporate users: It is a solidly constructed system packed with reliable components at a very competitive price.

The Gateway's tower case measures a hefty 25 by 7.5 by 16.5 inches; wheels to facilitate moving it would be welcome. Of the eight drive bays, the four 5.25-inch and two 3.5-inch are front-accessible, and two more 5.25-inch drive bays are internal. The drive bays make the 486/33C a good choice as a file server if you don't mind the ISA bus. Potential users should check out Gateway's desktop model with five drive bays. The 486/33C performed our tests about as well as any EISA system did. The company introduced its Gateway 486/33E, an EISA version of the system we tested, too late for us to review it.

The reviewed machine had a full-size Micronics motherboard, but Gateway was in the process of switching to a baby-AT Micronics motherboard. Both motherboards support 64MB of 70-nanosecond page-mode RAM but arrive at this total differently. All memory on the reviewed system is added to 16 SIMM sockets on the motherboard. The new motherboard has eight SIMM sockets that accept up to 32MB and a 32-bit slot that can take 32MB more on a memory board. Both motherboards use a 64K direct-mapped cache of 25-ns. SRAM, but no larger cache sizes are available. On the new motherboard, the SIMM sockets are located on the front of the case and are easy to reach, whereas cables blocked some of the sockets on the old board.

Both motherboards have eight 16-bit ISA slots. The video board and I/O board occupy two slots, leaving plenty of room for drive controllers, network interface boards, and other peripherals. Knockout panels on the back let you add five 25-pin and three 9-pin ports without having to fill panel openings reserved for slots. One of

FACT FILE



Gateway 486/33C
Gateway 2000, 610 Gateway Dr., N. Sioux City, SD 57049; 800-523-2000, 605-232-2000.
List price (tested configuration): $3 045.
Memory and processor RAM cache: 8MB 70-ns SIMMs, 64K cache
Disk drives and controller: Western Digital 15-ms, 200MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, MAG Computronic 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 493 ON READER SERVICE CARD

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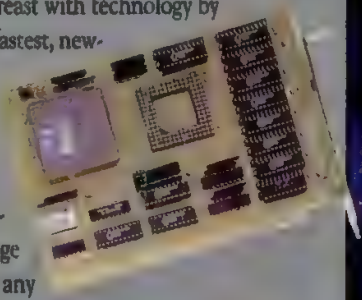

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CIRCLE 238 ON READER SERVICE CARD

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CIRCLE 166 ON READER SERVICE CARD

the slots on the new motherboard doubles as the 32-bit memory slot.

The tested machine costs $3,045; the desktop version is $100 less. The best part is that Gateway doesn't skimp to offer such a low price. For example, the 14-inch color monitor supports a noninterlaced signal at the 1,024-by-768 resolution and a refresh rate of 72 Hz, making it excellent for work in resolutions higher than 6[illegible]-by-480. Gateway also sells drives as large as a 1.2GB SCSI hard disk.

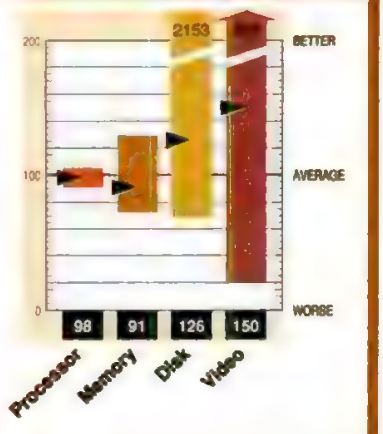
The 486/33C was in the upper half of the tested systems on PC Magazine Labs' processor benchmark test. The Western Digital Piranha 4200 hard disk with a built-in 64K buffer turned in a better-than-average time. The system was slightly above average on the video test and slightly below average on the memory test.

Gateway's 124-key keyboard, dubbed the AnyKey keyboard, has horizontal and vertical function keys, a macro record key, and other goodies. If this sounds too exotic, you can order a traditional 101-key keyboard. The 486/33C comes with a one-year parts-and-labor warranty and free on-site service from TRW. Toll-free technical support hours are generous: 7:00 A.M. to 1:00 A.M. weekdays and 10:00 A.M. to 3:00 P.M. Saturdays, E.S.T.

The Gateway 486/33C's speed won't dazzle you, and some people in the market for a server will want the power of the 32-bit EISA bus. But reliable components, good service and support, strong expansion capabilities, and a competitive price make it a strong value among ISA machines.

Gateway 486/33C

TEST RESULTS



In Short: The 33-MHz Gateway 486/33C is designed for use as a file server. Eight drive bays and a hard disk capacity as large as 1.2GB should satisfy most storage needs, but some users may want the more powerful EISA bus instead of this PC's ISA bus. The $3,045 price for the reviewed machine is excellent, especially since Gateway uses quality components and provides one year of free on-site service.

GOLDSTAR INC.

GoldStar GS433

by Tom Unger■Nothing inside the $2,699 small-footprint desktop GoldStar GS433 is on the cutting edge of current technology. But if you're in the market for a fast ISA workstation, this moderately priced system will fill the bill.

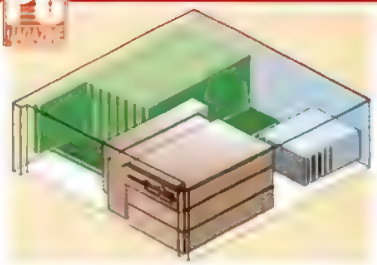
The GS433 won't set any speed records, but underlying the system's slightly below-average scores on PC Magazine Labs' benchmark tests is the idea that even a slow 486 33-MHz model is faster than almost anything available now. Can the GS433 compete against 486 EISA machines with processor RAM caches and caching disk controllers? Not a chance. But the GS433 will outperform comparably equipped 386/33s from Compaq, Dell, and IBM—and do so for less money.

You won't find many name-brand components in the GS433; its motherboard and 16-bit Super VGA card don't carry identifying lettering. The pass-through controller board for the IDE hard disk and floppy disk drive, which handles parallel and serial I/O, is similarly anonymous.

Our test unit included a GoldStar 1460 14-inch monitor capable of 1,024-by-768 resolution. Although the anonymous video card cannot produce noninterlaced 1,024-by-768, such a resolution is virtually unreadable on a screen this size anyway.

More to its credit, the GS433 is made of sturdy stuff—from its all-metal chassis and cover to its 211MB Seagate IDE hard disk and 200-watt auto-switching power supply. Despite its small footprint, the system also provides plenty of expandability. The power supply had five connectors—one for each of the five drive bays (three 5.25-inch and two 3.5-inch floppy disk drives). Four of these bays were accessible in our test unit; the internal one was occupied by a Seagate hard disk. The GS433 has seven 16-bit ISA expansion slots and one high-speed 32-

FACT FILE



GoldStar GS433
Goldstar Inc., 3003 N. First St., San Jose, CA 95134; 408-432-1331.
List price (tested configuration): $2,699.
Memory and processor RAM cache: 8MB RAM, no processor RAM cache.
Disk drives and controller: Seagate 19-ms. 200MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Trident 1,024-by-768 adapter with 1MB RAM, Goldstar 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 494 ON READER SERVICE CARD

In Short: The GoldStar GS433 proves that a generic and otherwise average ISA computer can be a great value. The GS433's average performance on PC Magazine Labs' benchmark tests is balanced by a below-average price tag and free on-site service for the duration of the one-year parts-and-labor warranty. While you cannot buy this machine direct, your distributor or computer superstore discount makes this an excellent buy.

bit slot for additional memory. Our GS433 test unit came with 8MB of 80-nanosecond SIMM RAM, expandable to 32MB on the motherboard.

Goldstar sells through large distributors such as Ingram Micro-D and through computer superstores as well. In neither case does it configure machines individually, although in most cases DOS 5.0 and Microsoft Windows 3.0 are included at little or no extra cost. Generally, Goldstar leaves the value-added work to the distributors and dealers and therefore would not quote prices for component or memory upgrades. In line with a welcome trend in the industry, Goldstar's standard one-year parts-and-labor warranty includes free on-site service from TRW, as well as toll-free technical support and parts swapping in emergencies.

This may not be the fastest or prettiest of the systems in our roundup. But for a single-user workstation, the combination of the GoldStar GS433's components and the powerful 486DX processor makes for a computer that gives you a lot of bang for your buck.

ERTZ COMPUTER CORP.
Hertz 486/33Ei

by Bruce Brown ■ Hertz Computer Corp. is one of many vendors that resell Intel-manufactured systems. At a time when many companies are still thinking about how much postsale service to give, Hertz goes the industry one better by offering presale service as well. The company lets large-account buyers bring in all their software and peripherals, install everything in a Hertz system at the vendor's New York location, and check to see if it all fits and works according to expectations.

Indeed, you might have to be a large-account buyer just to look at the machine:

It is not for sale directly to the public. Hertz sells through VARs or directly to government or corporate accounts. But if you are budgeted for expansion and need a high-quality EISA file server, the $7,995 Hertz 486/33Ei is too good to overlook.

The emphasis on presale and postsale service is only part of this ruggedly built system's value. Using Intel components, the motherboard holds 64MB RAM and has ten expansion slots. A 396-watt power supply ensures more than adequate power for eight drives (four with removable media). At $7,995, this system is well priced for what it offers (namely, an EISA bus and disk controller), though it is costly compared with many of the systems in this review.

Moreover, for a system intended as a file server, the Hertz 486/33Ei's monitor is first-rate: a 14-inch MAG PMV14VC Plus capable of a 90-Hz refresh rate at 1,024-by-768 resolution. Video is not integrated on the motherboard but is handled by a Diamond SpeedSTAR card with a Tseng chip set. The card holds 1MB of video RAM.

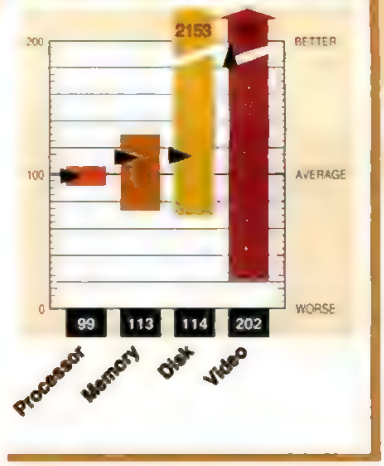
HIGH CAPACITY

Measuring 4 inches deeper than it is high (24 by 7 by 28 inches), the case of the Hertz system is deeper than usual, but with good reason. If you pack this system with drives, memory, and expansion boards you will want all the ventilation you can get. The high-capacity power supply is enough for the needs of a loaded system, and cooling is aided by a large auxiliary fan and plenty of internal space so that the components aren't all stacked on top of each other. Heavy-duty shielding has earned the system FCC Class B approval.

The Hertz 486/33Ei performed well on

Hertz 486/33Ei

TEST RESULTS



In Short: The Hertz 486/33Ei is an extremely rugged tower-style computer based on Intel system components. With its 64MB motherboard RAM capacity, eight drive bays, ten EISA expansion slots, and 396-watt power supply, this system is best used as a file server. It was a solid performer on PC Magazine Labs' benchmark tests, even for this already fast class of machines. With a fair price for the quality it provides, the 486/33Ei is a recommended buy.

WE HAVE A FEW WORDS FOR PEOPLE WHO DEMAND HIGH PERFORMANCE AND EXPECT TO PAY PEANUTS FOR IT.

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MORE POWER TO YOU.

You wanted it, you got it.

Introducing the Dell® 486P/20. A computer that gives you an i486™ SX processor at the price of an i386™ DX machine.

An incredible performance boost of up to 40% at virtually no additional cost.

intel inside

Generating enough processing power to exploit the full potential of future versions of Microsoft® Windows™ and OS/2.®

Making whatever software you run, run that much faster.

Giving you quicker recalcs, database compiles and screen refreshes.

In short, getting rid of excess wait.

And if that isn't impressive enough, the Dell 486P/20 comes with an upgradeable processor that can go from a 20 MHz i486SX chip all the way up to a high-end 33 MHz i486DX system, and even beyond.

Which, considering that we're talking about a computer under $2,000, is nothing short of revolutionary.

A true power user's desktop. For its low price, the Dell 486P/20 has a lot of technical innovations you wouldn't expect to find on even higher end machines. Things like programmable Flash EPROMs, for example, that make conventional methods of upgrading system BIOS seem almost obsolete. You won't have to take this computer apart and lose your patience trying to pry out a reluctant chip. Just slip in a diskette—that's all.

Expanding memory is equally convenient. One of the few PCs to support 16 MB SIMMs, the 486P/20 carries 4 memory expansion sockets, on its main board. So as your needs grow, you can keep adding RAM in 1, 4, or 16 MB increments up to a total of 64 MB. That's plenty of room to run your networking software, Microsoft Windows and just about any high-performance graphics application.

And talking about graphics, a small expansion of video memory to 1 MB (512K is standard) will put over 32,000 *colors* at your disposal, letting you create images that approach photographic quality.

The 486P/20 also makes those images a lot easier on your eyes. It supports up to 1024 x 768 non-interlaced video at a fast 70 Hz refresh rate for a flicker-free display. Unlike the kind you get on some competitive machines that are limited to 60 Hz non-interlaced.

An i486SX processor with the future built in. Because the Dell 486P/20 upgrades via a processor chip instead of traditional processor cards, upgrading takes the form of a single, economical step:

Just remove one chip and replace it with a higher performance version.

On the other hand, if you never need to upgrade at all, you don't end up having paid a price penalty to get the system in the first place. Either way, you win.

Apart from the processor, the 486P/20 is also designed to allow easy upgrading of hard disks, memory and video capability. So when your needs change, the rest of your computer can, too.

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ir savings increase with the sophistication of the Dell System* you buy. So go ahead, read on.
w the more our i486 systems cost, the less they actually cost.

MORE SPEED

From desktop publishing to spreadsheet applications, there's one feature that's always welcome, and that's speed. With quick recalcs and lightning fast screen refreshes, you'll get your work done faster with the Dell 486P/33.

The 33MHz i486DX processor generates up to 80% more performance than 33MHz i386DX systems. If that leaves you craving for more, you can upgrade to a faster i486 processor when available.

This 486P/33 configuration features a 100 MB hard drive with a phenomenal 15 ms average access time. An 8 KB cache in the processor boosts performance. And dual floppy drives allow you to read any diskette, regardless of MS-DOS format.

A 1024 x 768 non-interlaced big 15" color monitor with overscan gives you 30% more viewable area than the standard 14" you get with any competitively priced system. For even more versatility on desktop publishing or graphic-intensive applications, just expand video RAM to 1 MB and you'll get a 32,000 color, near-photograph quality display.

The system comes with 4 MB RAM on 32-bit SIMMs with gold-plated connectors, MS-DOS 5.0, Microsoft Windows 3.0 and a Microsoft Mouse.

THE DELL 486P/33 33 MHz i486DX SYSTEM.*
SYSTEM INCLUDES 100 MB HARD DRIVE, ULTRASCAN 15C MONITOR,
5.25"1.2 MB AND 3.5"1.44 MB FLOPPY DRIVES AND 4 MB RAM.
SAVE $948▽

MORE GRAPHICS

The Dell 486D/33 has every high-end feature you'd expect in an outstanding graphics workstation. Except a high-end price tag.

There's a superfast 33 MHz i486DX processor, with 8 KB internal cache. For even greater performance, all you'll need to do is replace a processor chip. So you can upgrade inexpensively as soon as new chips hit the market.

Should your workload, heaven forbid, triple by then, you'll still find the 200 MB hard disk more than adequate.

And as your requirements become increasingly more sophisticated, you can keep adding to the 486D/33's 8 MB RAM. With a maximum of 64 MB, there's plenty of room to grow.

Talking about room, we have a large 15" flat square monitor with 30% more viewable area than a standard 14" monitor, which makes those large spreadsheets and high resolution documents much easier to read.

The Dell 486D/33 comes with factory-loaded MS-DOS 5.0, Microsoft Windows 3.0 and a Microsoft Mouse.

THE DELL 486D/33 33 MHz i486DX SYSTEM.*
SYSTEM INCLUDES 200 MB HARD DRIVE, ULTRASCAN (1024 x 768) 15C MONITOR,
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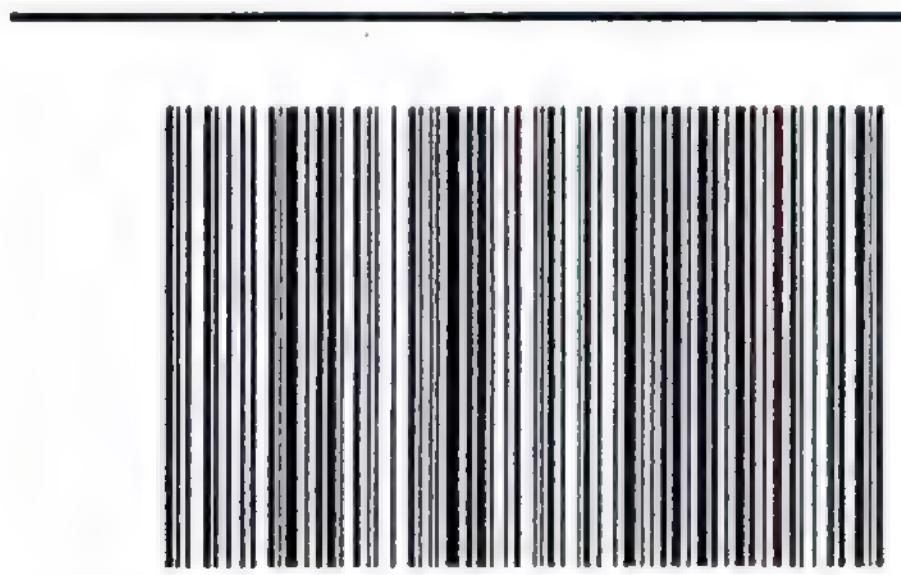

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Foldout slip-sheet

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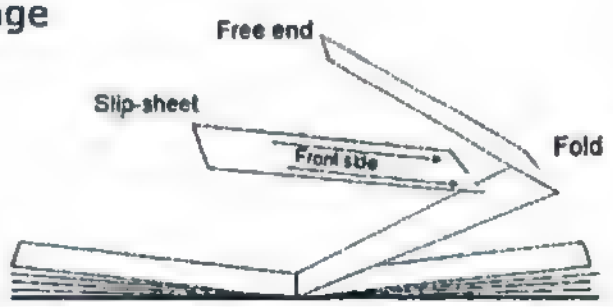
3. Slice the folded edge
4. Close the page and slip-sheet



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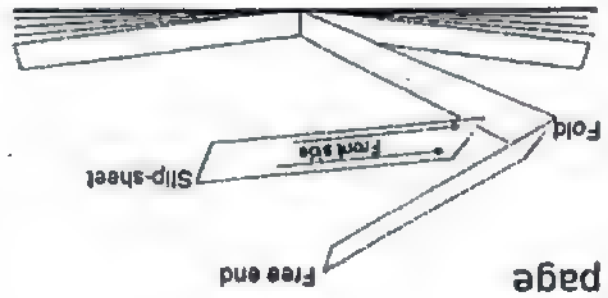

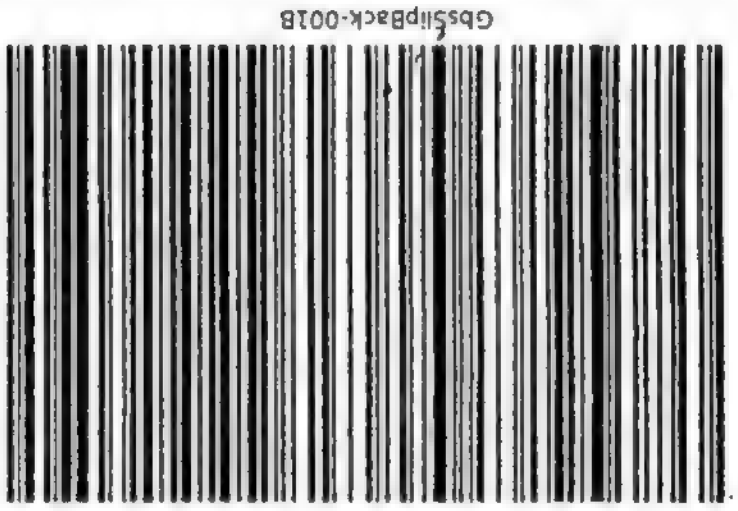

Back

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Inverted Back

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THE MORE YOU GET, T

If your requirements call for a more powerful or specialized system than the one
even better deal with our higher-end i486 systems. From $248 all the way up to a whopping $1,348,
And if you still have any doubts, call us. We'll be happy to explai

MORE VALUE

The Dell 486P/20 is a 20 MHz i486SX general purpose workstation you can upgrade to 33 MHz and beyond.

For a configuration that costs so little, you sure get a lot.

Like programmable Flash EPROMs for easy BIOS upgradeability.

And an 80 MB hard disk drive with 15 ms access time.

And an 8 KB cache built into the processor for increased throughput.

And 4 MB of RAM on 32-bit SIMMs with gold-plated connectors for greater reliability.

And 2 floppy drives.

Surprised? Keep reading.

You'll also get a 1024 x 768 14" color monitor with long persistence phosphors.

And the power to display 32,000 colors simultaneously, if you expand video memory to 1 MB.

And factory-installed MS-DOS® 5.0 and Microsoft Windows 3.0.

And a Microsoft Mouse.

And, considering it's from Dell, a whole lot of peace of mind.

That, by itself, is worth a fortune.

THE DELL 486P/20 20 MHz i486SX SYSTEM.*

SYSTEM INCLUDES 80 MB HARD DRIVE, SUPER VGA (1024 x 768) COLOR MONITOR, 5.25"1.2 MB AND 3.5"1.44 MB FLOPPY DRIVES AND 4 MB RAM.

SAVE $248▽

MORE PRODUCTIVITY

The Dell 486D/25 is a sophisticated productivity workstation that was designed with your future in mind. To upgrade from a 25 MHz i486SX processor to a faster processor when available, all you'll need to do is replace a processor chip. Not a card. And starting with 4 MB, you can keep adding RAM up to a maximum of 64 MB.

This new system is priced on par with 33 MHz i386DX machines, yet performs up to 40% faster. And its sheer processing power is amply backed by a 100 MB hard drive with a 32 KB cache for increased throughput. A dual floppy drive completes the excellent storage arrangement.

A 1024 x 768 14" color monitor with a 70 Hz refresh rate gives you a flicker-free display. With 32,000 colors, if you make a small expansion of video RAM. Should anything go wrong, the built-in SmartVu™ diagnostic display can find the problem, even if the monitor goes down.

The 486D/25 comes with six expansion slots and five drive bays for added flexibility. You'll also get factory-loaded MS-DOS 5.0, Microsoft Windows 3.0 and a Microsoft Mouse.

THE DELL 486D/25 25 MHz i486SX SYSTEM.*

SYSTEM INCLUDES 100 MB HARD DRIVE, ULTRASCAN™ 14C MONITOR, 5.25"1.2 MB AND 3.5"1.44 MB FLOPPY DRIVES AND 4 MB RAM.

SAVE $748▽

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Gold-plated SIMMs increase system reliability by eliminating connection-related errors

There are plenty of companies anxious to sell i486 systems at a low price. All they really need is a supply of parts (the cheaper, the better) and a garage to assemble them in. Once the "production line" gets going, they place a few ads in the paper. After that, of course, it's anyone's guess as to which will last longer: the computer or the "company" it came from.

The 486P/20 is one of the few computers to feature 16 MB SIMMs

At Dell, on the other hand, we offer lower prices by cutting down on traditional retailer mark-ups, not quality. In fact, we're almost fanatical about the quality of every machine that leaves our state-of-the-art factory. That attitude is reflected in the way we design, test, manufacture and ship our i486 systems.

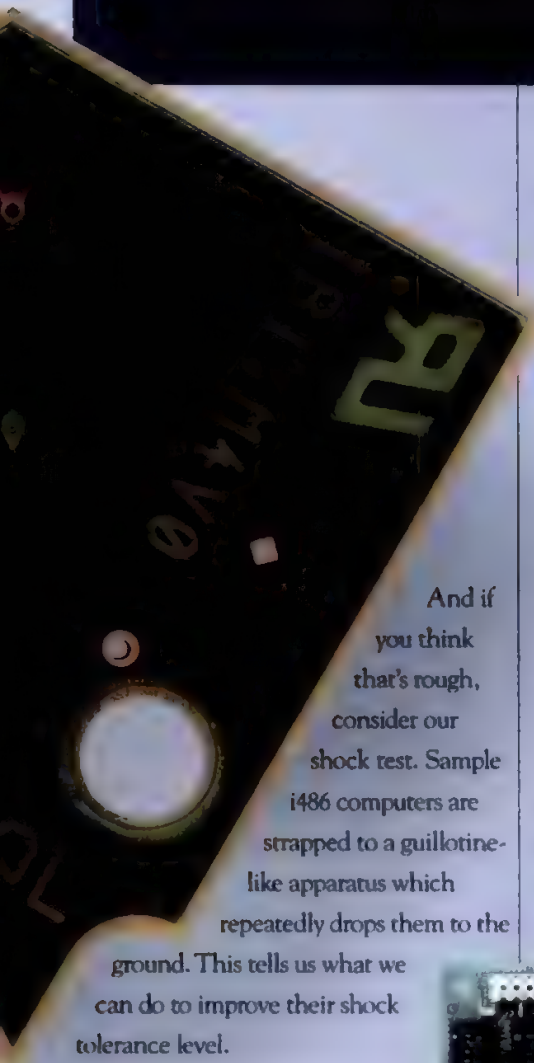
To see how our i486 systems stand up to air delivery, we use a Black Box. Or, in technical parlance, a portable accelerometer/thermometer. This little device is fitted into a test computer which we then send out through regular delivery channels, much as if you had ordered it yourself. When we bring it back, the "Black Box" tells us exactly what the computer went through, in terms of shock, vibration and temperature. This innovative test is part of a series that's been so successful in helping us improve our packaging, we've won an international award for package design.

Our Black Box test makes sure your Dell computer never arrives this way

To make our computers more reliable, we cook them. After our computers are fully assembled and configured, randomly selected units are "burned-in" and tested at 104°F.

In perhaps the most grueling temperature test we've ever come up with, pilot Dell systems must survive a storage chamber where temperatures vary rapidly between −40°C and +60°C.

JUST BECAUSE YOU PAY LESS DOESN'T MEAN YOU GET LESS.



And if you think that's rough, consider our shock test. Sample i486 computers are strapped to a guillotine-like apparatus which repeatedly drops them to the ground. This tells us what we can do to improve their shock tolerance level.

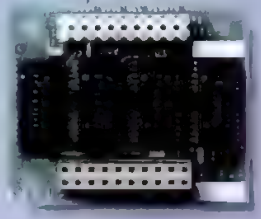
Our power supply units undergo an equally rigorous quality control process. In a test that simulates several years of actual usage, randomly selected test units are switched on and off *1,200 times*; only then can they be approved.

While our testing may seem a little extreme, it's based on a rather simple fact: if our machines don't fail with us, they haven't much chance of failing with you, either.

Our computers have a heart of gold. At Dell, we take quality consciousness so seriously, we fit our i486 systems with SIMMs that have gold-plated connectors. If you're wondering what such expensive components are doing in relatively inexpensive computers, the answer is simple: they cost us a bit more, but by eliminating connection-related errors, they're worth their weight in gold.

It's exactly this kind of commitment to quality control that's enabled us to meet CSA, UL, TUV-GS, FCC and VDE standards, earning worldwide regulatory approvals.

There are thousands of ways to use a Dell i486 system. Dell i486 systems are tested for compatibility with major peripherals, software applications, network topologies and network operating systems, including Banyan and Novell, in several hundred permutations per system. They're even tested for AS-400 connectivity. So you can use our machines in virtually any environment.



A small expansion of video memory gives you over 32,000 colors for a near photographic quality display.

50% fewer opportunities for things to go wrong. After the traditional computer manufacturer builds a system, it goes to the dealer, who then does his own configuring. That's 2 stages of manufacturing, which means twice as many opportunities for things to go wrong.

Random Dell computers are "burnt in" at 104 degrees Fahrenheit.

A Dell i486 system, on the other hand, is manufactured only once. We custom-configure memory boards, network cards and advanced video, testing the system as a unit.

We even load select software packages you buy from us, at no cost to you. That includes MS-DOS 5.0, Microsoft Windows 3.0, and many popular applications programs.

With 20 diskettes and 2 hours to load and configure just one system, imagine the time you'll save and the potential hassles you'll avoid. Which gives you yet another reason to buy a Dell i486 system:

When you open the box, you're ready to go.

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WE TH NK A COMPUTER SHOUL COME WITH MORE SUP ORT THAN THIS.

As a potential buyer, you'll receive lots of attention from most computer companies. Until they receive your check, that is. For all practical purposes, once the sale is closed, so is the company.

At Dell, on the other hand, half our story begins after you receive your computer. Despite our low prices, we've built a reputation for the highest level of support in the industry.

To begin with, a Dell expert works with you to figure out which computer, with which options, works best for you. We help you arrange financing from a wide variety of credit, lease and lease-to-buy plans. Then we test, pack and ship your personalized personal computer to you via two-day air standard.

In the unlikely event that you have a problem with your computer, it won't last long. Our technical support staff solves 90% of reported problems over the phone. Usually in six minutes or less.

You can also get technical help 24 hours a day via our innovative TechFax℠ line. Just dial up and detailed system information will be automatically faxed back to you from the Dell Technical Library.

We even have a special section on CompuServe's PC vendor forum. So you can view other users' problems, and, more importantly, our solutions. But what makes our bulletin board special is that we constantly monitor what goes on there. Which means we can keep track of any small problems, and stop them before they become big ones.

But what if you have a problem that just can't be solved over the telephone?

Dell has built
by building a r
46 million dollar business
ship with every custome

On-site service is an ambiguous term.

To some enterprising vendors, it conveniently means that the replacement parts, and not the service technician, will arrive on-site. Which isn't as crazy as you may imagine; there are any number of do-it-yourself computer whiz kids in this business.

If you don't count yourself among their

ranks, you'll prefer Dell's way of supporting our machines.

If needed, a trained technician can be at your home or office with a solution in hand, usually by the next business day.△

What's more, every time you call Dell Tech Support an entry is made in our customer database. So over time, we'll know your computer as well as you do. Maybe even better.

Every Dell Computer comes with a trained computer staff who knows your computer as well as you do. Maybe better.

And you get all this support without getting a bill. Because the price of your system includes on-site service coverage for a year, and phone support forever.

Buy a computer and get the company.

By standing firmly behind every machine we've ever sold, we've built up a $546 million company in just seven years, one customer at a time.

On the way, we've acquired quite a following. For example, the editors at *PC Week* have described the Dell service and support package as "overkill." J.D. Power and Associates® ranked Dell "Best PC in Customer Satisfaction in Small to Medium Sized Businesses."

We've won *PC Week's* Customer Satisfaction Poll an unprecedented eight times.

And in the last 12 months alone, we've collected 53 product awards, including *PC Magazine's* Editor's Choice, *InfoWorld's* Buyer's Insurance and *PC World's* Best Buy and World Class Awards.

Last year, Dell won customer satisfaction polls in the U.S., U.K., Germany and France.

And it's not just the smaller users that are satisfied, either: Dell computers are now used by over two-thirds of the FORTUNE 500.® Overseas, it's been pretty much the same story. We've more than doubled our overseas sales in the last 3 years in a row, and won in customer satisfaction surveys in the UK, Germany and France.

Still can't decide? Take 30 days to make up your mind. Within that time, if you aren't completely satisfied, just return your Dell system and we'll refund your money, no questions asked.

We're proud to add, though, that this unconditional guarantee has been used so sparingly, only 1.2% of the over half a million computers we've sold so far have ever come back.

What does keep coming back, in ever increasing numbers, are our customers. Over 70% of the people who buy a Dell computer buy another. That's perhaps the strongest statement of satisfaction any manufacturer could ever hope to receive.

So before you buy an i486 system, ask around; there are plenty of Dell users out there. And if there's anything you need, call us. But you'd better hurry.

Great computers may last a long time but great deals don't.

Our 53 product awards in 1991 alone make Dell one of the most awarded PC companies in the world.

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Fill this out, fax it to us and we'll send back a price quote, spec sheet and any other information you may need on our line of i486 systems.

PROCESSOR
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- ☐ i486SX, 25 MHz
- ☐ i486, 33 MHz
- ☐ i486, 50 MHz

ARCHITECTURE
- ☐ EISA
- ☐ ISA

CHASSIS
- ☐ Small Footprint
- ☐ Mid-Size
- ☐ Floor-Standing

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- ☐ 5.25"

MEMORY
- ☐ 4 MB
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- ☐ 16 MB

HARD DRIVES
- ☐ 50 MB
- ☐ 80 MB
- ☐ 100 MB
- ☐ 200 MB
- ☐ 320 MB
- ☐ 650 MB
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_____

_____

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Title _____

Company _____ (If Applicable)

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Please have a Dell representative call me at

( ) _____

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FOR MORE INFORMATION, PLEASE FAX US.
#11BR7

PC FACT FILE

Hertz 486/33Ei
Hertz Computer Corp., 325 Fifth Ave., New York, NY 10016, 800-232-8737, 212-684-4141
List price (tested configuration): $7,995.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 128K cache
Disk drives and controller: Micropolis 14-ms. 380MB SCSI hard disk, DPT controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 512K RAM, MAG Computronic 14-inch monitor.
Monitor refresh rate: 70 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 495 ON READER SERVICE CARD

PC Magazine Labs' benchmark tests, with good scores on the memory, processor, and video tests. Its score on the disk test, though still faster than the historical average for this class of machines, was one of the slowest in the current review. That is mainly because the EISA drive controller, which ordinarily comes with a drive cache (up to 16MB cache possible) was supplied without any cache at all in compliance with the review specifications for this issue. Combining the EISA bus-mastering drive controller with a decent cache size should yield excellent access and throughput times.

On-site service, supplied by Intel service centers worldwide, costs a percentage of the total system price per year, averaging about $395 a year. Hertz offers telephone support from 8:30 to 5:30 E.S.T. Monday through Friday only, and preships parts. You can also send the unit to the company with one-way shipping paid. If you need this much machine, however, you will probably want the assurance that comes with the on-site service.

If all you want is a heavy-hitting workstation, you can buy a desktop equivalent (with less expansion room and a smaller power supply) for $1,400 less from Hertz. But for a full-blown, fully expandable file server or just an all-out everything system, the tower version of the Hertz 486/33Ei is certainly worth the extra money.

HEWLETT-PACKARD CO.
HP Vectra 486/33T

by Bruce Brown. Lots of people rest easy with equipment from Hewlett-Packard Co., knowing they have purchased high-quality goods backed by the company's reputation for top service and support. At $11,929 for the configuration we requested, the HP Vectra 486/33T isn't the least expensive 486 33-MHz you can buy; it is a good example of HP quality, though, and you are likely to find some discounts on this price. If you're in the market for an EISA file server with plenty of expansion room, the Vectra is a strong choice.

The numbers speak clearly of the system's expansion room: 64MB RAM potential on the standard memory card, six 5.25-inch drive bays with exposed fronts, and eight EISA slots. The HP comes with a 360-watt power supply with six storage-device power leads. The Vectra doesn't have an FCC Class B certification number, nor will HP submit the system for approval, because the company says it has no intention of selling the system for home use.

The Vectra looks as if it could meet anyone's standards—including the FCC's. The good-size case (24 by 8.5 by 20.5 inches) has sturdy feet to support the tower configuration. Inside the case, the HP motherboard bucks the current integration trend: It uses cards for most system components.

HP doesn't market the Vectra as an upgradable machine, but the CPU, the 128K 20-nanosecond RAM cache, the support chip set, and the ROM BIOS are all on a CPU module card in a proprietary slot. There's also a memory card with eight SIMM sockets that fits into a separate slot on the motherboard. The tested configuration had four SIMMs installed, each bearing 2MB of RAM. The slots accept either 2MB or 8MB SIMMs, for a potential 64MB of RAM.

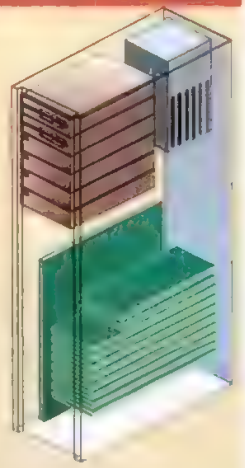
Two small cards, again with their own slots, provide the circuitry and connectors for the Vectra's ports (one parallel, two serial, one keyboard, and one mouse port). The motherboard has a built-in IDE interface, which can be disabled if you want to use an EISA drive controller. The test system's video card was an HP Ultra VGA board with 1MB video RAM and an S3 video accelerator chip.

True to the S3 chip's nature, the benefits of this card are not reflected in the video score because our test measures character-based performance. On PC Magazine Labs' other benchmark tests—processor, memory, and disk—the system yielded average performance.

HP's warranty includes free on-site service for the first year by HP's own service centers. Service contracts for subsequent years cost $300 per year. The service response time is within 48 hours.

The HP Vectra 486/33T has ample space, power, and ventilation capacity to

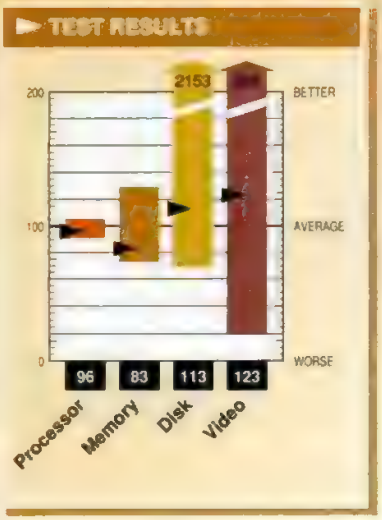
PC FACT FILE



HP Vectra 486/33T
Hewlett-Packard Co., 19310 Prunendge Ave., Cupertino, CA 95014; 800-752-0900.
List price (tested configuration): $11,929
Memory and processor RAM cache: 8MB 80 ns SIMMs, 128K cache
Disk drives and controller: Quantum 16-ms. 168MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Hewlett-Packard Super VGA adapter with 1MB RAM, Hewlett-Packard 14-inch monitor.
Monitor refresh rate: 60 Hz.
Software: DOS 5.0.

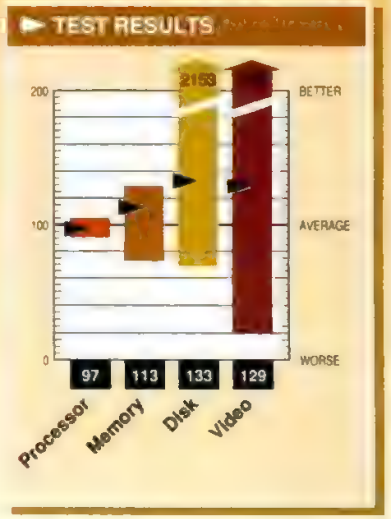
CIRCLE 496 ON READER SERVICE CARD

HP Vectra 486/33T



In Short: Hewlett-Packard's reputation for quality design and construction is reflected by the HP Vectra 486/33T. This tower-case system is perfect for use as a high-end file server, due to its 64MB RAM potential, six front-accessible drive bays, eight EISA slots, and 360-watt power supply. HP has a reputation for quality control and strong service backing, both of which make paying the premium price a smart move.

IBM PS/2 Model 90 XP 486



In Short: IBM has turned away from previous system designs: The IBM PS/2 Model 90 XP 486 has its most essential circuitry mounted onto a proprietary module for easy upgrade to 50 MHz and beyond. There are only three free slots, but XGA video, I/O, and a mouse port are on the motherboard. Also, the included SCSI adapter can run several devices. Solid construction, acceptable speeds, and a few good innovations mark this expensive but worthy choice.

be fully configured and operational for years of service. Single-system users probably can't use this much computer or justify its cost, but as a file server the Vectra will let many system managers breathe easier.

IBM CORP.

IBM PS/2 Model 90 XP 486

by Edward Perratore■Falling PC prices have turned many heads toward companies that market powerful machines at affordable rates. IBM Corp. is not among them, but Big Blue's first true 486 desktop model—the IBM PS/2 Model 90 XP 486—is packed with enough worthwhile features to sway many buyers.

To begin with, the Model 90 XP 486 departs from IBM's tradition of integrating the PC's chief components on the motherboard—with good reason. The processor complex, as IBM has termed its CPU module, includes the CPU, supporting circuitry, 256K external RAM cache, and Micro Channel bus control logic in a variation of passive backplane technology. This lets you upgrade to a faster processor (a 50-MHz module is available) and take advantage of enhancements in the Micro Channel specification (though our tests showed no advantage to 32-bit buses in general).

What you do find on the motherboard is the XGA video adapter (initialization of which makes for one slow boot), DMA I/O ports that allow for faster throughput than you'd otherwise find, a mouse port, connectors for the two floppy disk drives, and what may be taken as a shortage of expansion slots.

The far left slot holds a cached SCSI adapter, which runs the 320MB hard disk that came with our unit. (IBM says only a caching controller is available with this model; this controller will also run a SCSI tape backup or CD-ROM drive.) The CPU card's slot is proprietary; so are two others that hold memory cards accommodating up to 64MB of RAM in 70-nanosecond SIMMs. This arrangement leaves only three slots free, though you won't need them for mouse, video, or SCSI device control.

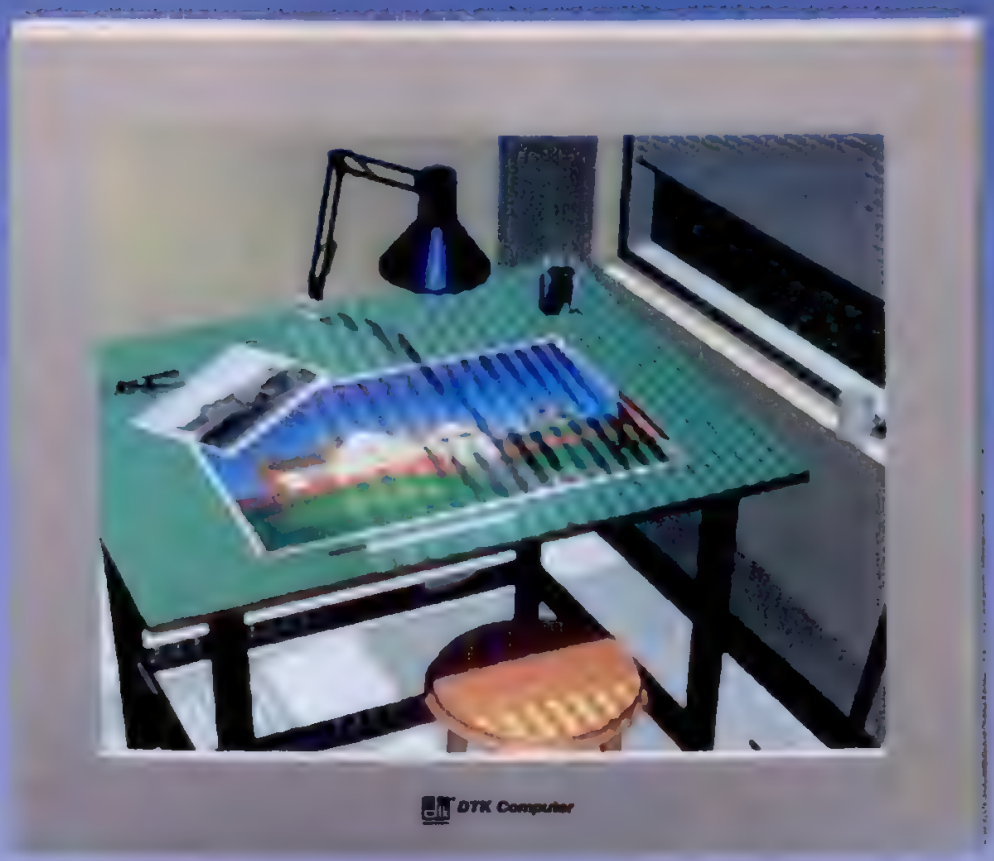
The PC's front panel does not hold a turbo or reset switch, but there's a surprise: a 5.25-inch drive bay in a product line that had all but abandoned the 5.25-inch format. Disk drives like IBM's 5.25-inch Slim-High drive, as well as the standard 3.5-inch floppy disk drive, rest atop metal rails that glide into the bays and snap into place; release of a metal clip allows for easy removal. Two hard disk bays lie beneath it.

Another innovation is IBM's use of a hard disk portion for diagnostic and configuration data, plus extensions to IBM's BIOS. Invisible to the user, this information is used to reconfigure the machine for you if you've changed your PC in any way.

Aside from a last-minute jumper wire on the processor complex (three more being on the SCSI adapter), the solid construction of the machine and its case demonstrates the workmanship that has given IBM its reputation. And the case uses easily removable thumbscrews.

On PC Magazine Labs' benchmark tests, the MCA bus showed no particular advantage. Except for its third-place finish on the disk test, the PC fell in with the pack. Its XGA circuitry and Color Display 8515 monitor scored in the midrange.

As ever, IBM's support policy lies in the hands of dealers. Parts and labor are covered, but all the service during the one-year parts-and-labor warranty period is out of IBM's hands. Nevertheless, IBM maintains its attraction with a serious machine. If you can foot the bill—$10,150 for a configuration that includes a 160MB hard disk, or $13,170 for what we



DTK 486 drives high-performance software in PC Week Labs test.

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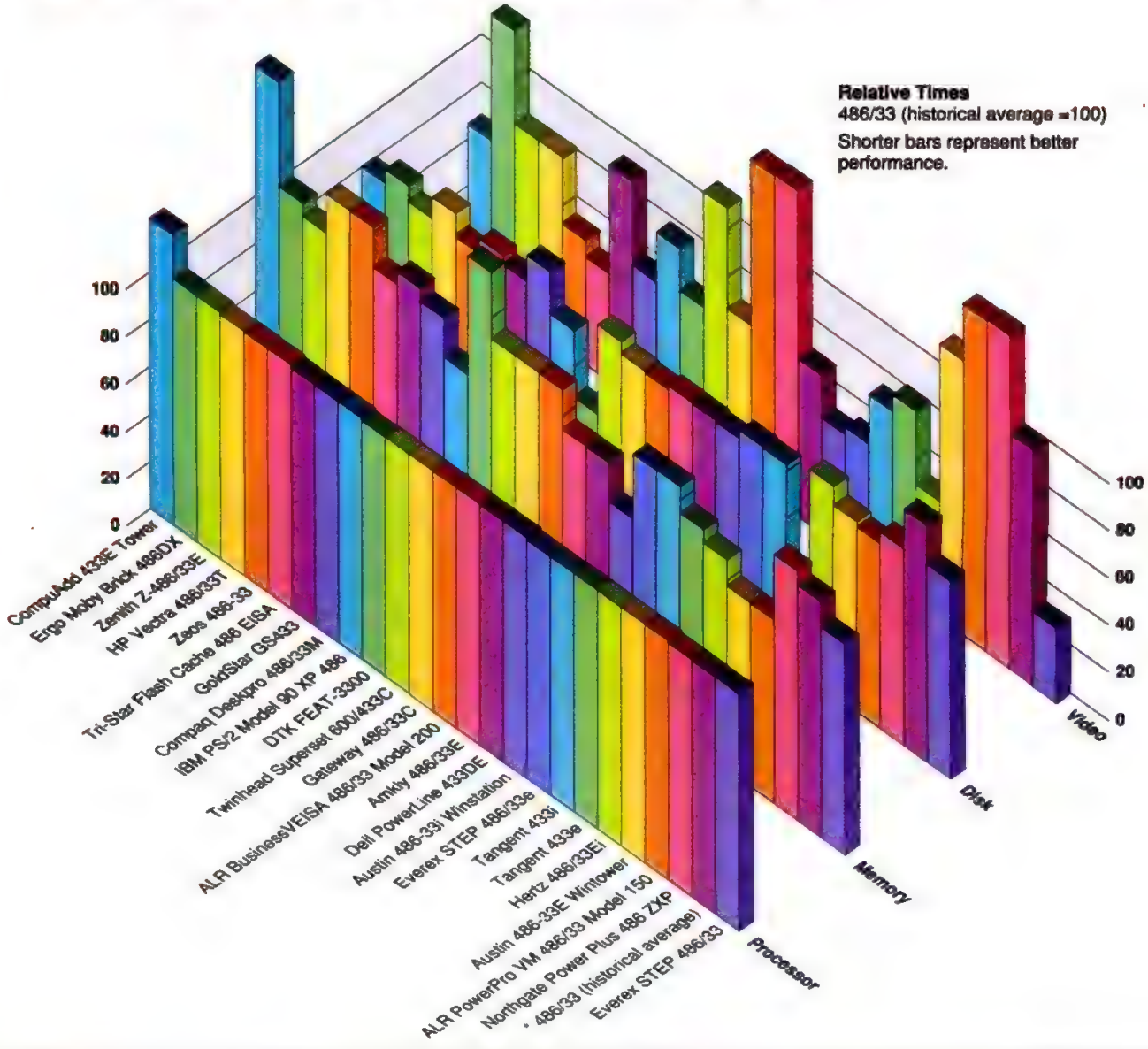
CIRCLE 102 ON READER SERVICE CARD

BENCHMARK TESTS: 33-MHz 486-BASED PCs

Don't look for a great variation in processor performance among these 486/33 PCs. You will find the real differences in disk and video scores. The DTK FEAT-3300, with its IDE hard disk, turned in the best uncached disk score; the Tri-Star Flash Cache 486 EISA produced the best video time.



Among the 13 EISA, 10 ISA, and lone MCA 486/33 PCs we tested, there were few if any performance differences directly attributable to bus architecture. Performance differences mostly occurred in disk and video scores and were based on components, not architecture. Austin, Everex, and Tangent submitted one EISA and one ISA system each, but these PCs showed no significant patterns.

With the exception of the CompuAdd 433E Tower, which originally came to PC Magazine Labs without a second-level cache, the processor-score graph is essentially flat. (CompuAdd later supplied that cache; see the product review for more information.) Both the Austin 486-33E Wintower and Austin 486-33i Winstation tied with the ALR PowerPro VM 486/33 Model 150 for the best memory test score, followed by the ISA-bus Everex STEP 486/33. The Hertz 486/33Ei and IBM PS/2 Model 90 XP 486 also tied for second, with the trio of Amkly 486/33E, Dell PowerLine 433DE, and Tangent 433e sharing third place. All of these win/place/show entries performed better than the average for 486/33 machines previously tested by PC Labs. Most systems ran at or near our historical average for memory performance, though the CompuAdd 433E Tower and DTK FEAT-3300 lagged behind.

Uncached disk scores continue to improve: Every single system we tested in this roundup scored better than the 50.4-second average for previously tested 486/33s. Tangent, which sells its 433E EISA configuration only with a Mylex SCSI-2

Lower scores represent better performance.	Processor	Memory	Disk	Video
CompuAdd 433E Tower	1.35	0.28	40.53	1.04
Ergo Moby Brick 486DX	1.15	0.20	43.48	1.87
Zenith Z-486/33E	1.15	0.19	40.06	1.26
HP Vectra 486/33T	1.14	0.22	44.70	1.26
Zeos 486-33	1.14	0.22	39.83	0.82
Tri-Star Flash Cache 486 EISA	1.14	0.19	42.93	0.71
GoldStar GS433	1.13	0.20	41.26	1.43
Compaq Deskpro 486/33M	1.13	0.19	46.76	0.88
IBM PS/2 Model 90 XP 486	1.13	0.16	37.80	1.21
DTK FEAT-3300	1.12	0.25	23.90	0.94
Twinhead Superset 600/433C	1.12	0.20	42.71	1.70
Gateway 486/33C	1.12	0.20	40.06	1.04
ALR BusinessVEISA 486/33 Model 200	1.12	0.20	39.82	2.14
Amkly 486/33E	1.12	0.17	40.87	2.15
Dell PowerLine 433DE	1.12	0.17	40.65	1.05
Austin 486-33i Winstation	1.12	0.14	40.22	0.77
Everex STEP 486/33e	1.11	0.19	42.05	0.82
Tangent 433i	1.11	0.19	41.72	1.15
Tangent 433e	1.11	0.17	2.13	1.26
Hertz 486/33EI	1.11	0.16	44.26	0.77
Austin 486-33E Wintower	1.11	0.14	40.29	1.81
ALR PowerPro VM 486/33 Model 150	1.11	0.14	39.35	2.19
Northgate Power Plus 486 ZXP	1.10	0.19	41.85	2.20
* 486/33 (historical average)	1.10	0.18	50.37	1.56
Everex STEP 486/33	1.10	0.16	42.08	0.49

* Reported for comparison.

HOW WE TESTED

In testing these 24 486/33 PCs, we used PC Magazine Labs' Hardware Performance Tests, Release 5.7, with the RAM cache and all shadowing enabled wherever possible. Disk performance is reported without software disk caches, and no RAM-resident programs were loaded for any tests. The margin of error for the processor, memory, and video benchmark tests is 0.05 seconds, so take this into account when making purchasing decisions based primarily on speed.

■ The **80486 Instruction Mix** benchmark test times a series of tasks specific to the 80486 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

■ The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at relatively slow access speeds.

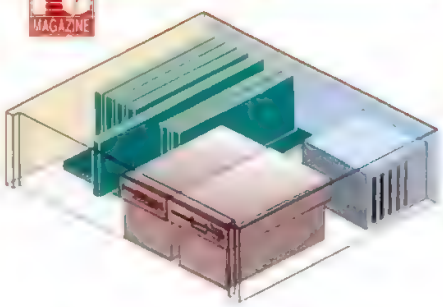
■ The disk score is the sum of the small-record and large-record **DOS File Access** benchmark test times. Each test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. No software cache is employed.

■ The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. A good score indicates that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and write directly to the screen.

caching controller, was a hands-down winner. Because this controller contains a cache and an on-board processor, it allowed the system to complete the PC Labs disk test in 2.13 seconds, compared with the remainder of this roundup's 40.7-second average. Among the rest of the systems, the DTK FEAT-3300's Quantum LPS-240 15-millisecond IDE hard disk completed the test in 23.9 seconds—nearly 14 seconds faster than its closer competitor, the IBM PS/2 Model 90 XP 486. The latter has a caching controller and 12.5-ms. SCSI hard disk.

Like the disk scores, which beat our historical average, the video scores for this group of machines also showed improvement. Past trends held true: Boards featuring Tseng chip sets scored best; Orchid cards designed with the S3 accelerator produced poor numbers on our text-based test. The S3 advantage shines in applications tailored for Microsoft Windows 3.0, however. Nine of the tested systems relied on Tseng video, while another seven used S3 implementations.

FACT FILE



IBM PS/2 Model 90 XP 486
IBM Corp., 113 Westchester Ave., White Plains, NY 10604; 800-426-9292.
List price (tested configuration): $13,170.
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 256K cache.
Disk drives and controller: IBM 12.5-ms. 320MB SCSI hard disk, IBM controller, 1.2MB and 1.44MB floppy disk drives.
Display: IBM 1,024-by-768 XGA adapter, IBM 14-inch monitor.
Monitor refresh rate: 43.5 Hz (interlaced).
Software: DOS 5.0.

CIRCLE 497 ON READER SERVICE CARD

tested—you won't be disappointed with the IBM PS/2 Model 90 XP 486, especially if you find the 25 to 30 percent discounts frequently available on IBM systems.

NORTHGATE COMPUTER SYSTEMS INC.

Northgate Power Plus 486 ZXP

by John R. Quain ■ Boasting a system with a graphical user interface video display, enough internal storage space to please the local library, and 33-MHz 486DX performance, direct-market kingpin Northgate Computer Systems wants to lure Microsoft Windows users with its Northgate Power Plus 486 ZXP. Designed as a "Windows workstation," this $3,899 ISA PC offers better-than-average performance and extra features that explain how Northgate has cut into IBM and Compaq territory.

The 15-millisecond 212MB Maxtor IDE hard disk in our evaluation unit turned in average test results. The system arrived in a tower case. A baby-AT case is standard, but the larger case added just $100 to the system price while offering three additional internal 5.25-inch bays. Using hard disk options from Northgate—rang-

ing up to a 14-millisecond 1.2GB SCSI hard disk ($3,600)—you can put nearly 3GB of disk storage inside.

A reduced-size Mylex motherboard, featuring an OPTi chip set with password protection and video/system BIOS shadowing, gives the system its extra room. For painless CPU upgrades, the motherboard uses a zero-insertion-force (ZIF) socket that lets you remove the processor by pulling a lever. Its processor benchmark test result allayed any concerns that the special socket might hinder speed. Together with adjustable system clock chip and jumper settings, the ZIF socket will allow you to upgrade to a 50-MHz 486DX or one of Intel's future dual-clock 486 chips. To squeeze out more performance for CAD applications, the motherboard will accept a Weitek math coprocessor ($1,199). Further expansion needs are met by six 16-bit ISA slots (only one of which is occupied) and one free 8-bit slot.

The Northgate Power Plus 486 ZXP came with 8MB of 80-nanosecond DRAM and a 64K external 15-ns. SRAM cache to meet the configuration requirements for this issue. The motherboard's eight sockets were filled with 1MB SIMMs, which means that if you want to increase memory—up to 32MB ($250 for 4MB SIMMs)—you'll have to toss out the original SIMMs. On PC Magazine Labs' benchmark test, the 486 ZXP yielded an average memory timing.

The most obvious GUI advantage that the 486 ZXP offers is its video subsystem. Northgate installs as standard the Orchid Fahrenheit 1280° video adapter. The Orchid's 1MB of fast dual-ported VRAM and S3 VGA controller, which performs hardware BitBlt (bit-block transfer) functions commonly used in Microsoft Windows 3.0, translate into better graphics performance.

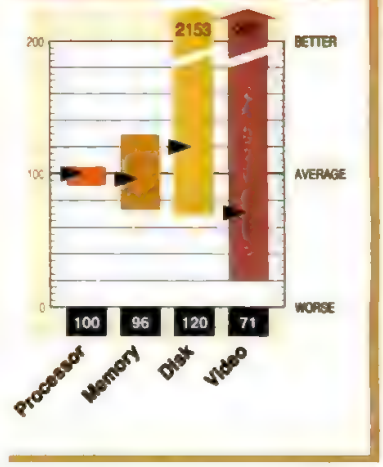
Unfortunately, these functions don't translate into faster VGA performance in DOS, as our text-based video test reveals. Users may not even see much of a speed gain in DOS graphics applications, such as *AutoCAD* or *Harvard Graphics*. But any application in Windows will reap the benefits of the S3 graphics accelerator (First Looks, *PC Magazine*, November 26, 1991, page 50). Users GUI-bent on color will also appreciate Orchid's 72-Hz Super VGA vertical refresh rate and the socketed Sierra RAMDAC, which can display 32,768 colors in VGA resolution (256 colors in noninterlaced Super VGA and 1,024-by-768 modes).

To ensure that none of this graphical power escapes your attention, Northgate includes NEC's MultiSync 3FGx 14-inch monitor. It is capable of handling everything the Orchid board can put out (except 1,280- by 1,024-pixel resolution) and even includes pin-cushion correction and a degaussing button among its front-panel controls.

For all its benefits, the Northgate Power Plus 486 ZXP faces tough competition from similarly priced and outfitted PCs based on more advanced 32-bit EISA boards from Austin and Zeos. To stave off lower-priced PC toughs, however, Northgate throws in lots of extras: a programmable Omnikey/Ultra keyboard, a floppy disk with copies of the AUTOEXEC.BAT and CONFIG.SYS files, a handy reference card listing the original CMOS setup, and an excellent user manual. The one-year parts-and-labor warranty supplies free on-site service and round-the-clock, 365-day-a-year toll-free technical phone support. This is about as secure as any vendor is ever going to make you feel.

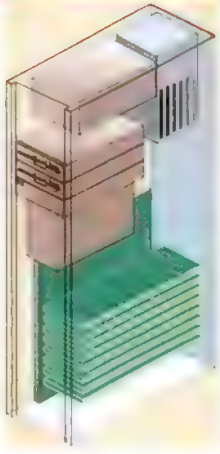
Northgate Power Plus 486 ZXP

TEST RESULTS



In Short: The $3,899 Northgate Power Plus 486 ZXP is another attractive ISA PC from Northgate, designed to entice users of Microsoft Windows 3.0. It comes with the GUI-minded Orchid Fahrenheit 1280° video adapter and NEC's latest 3FGx monitor. It was an average performer in a group of 33-MHz overachievers, but Northgate bundles the system with plenty of additional service and support to keep users happy.

FACT FILE



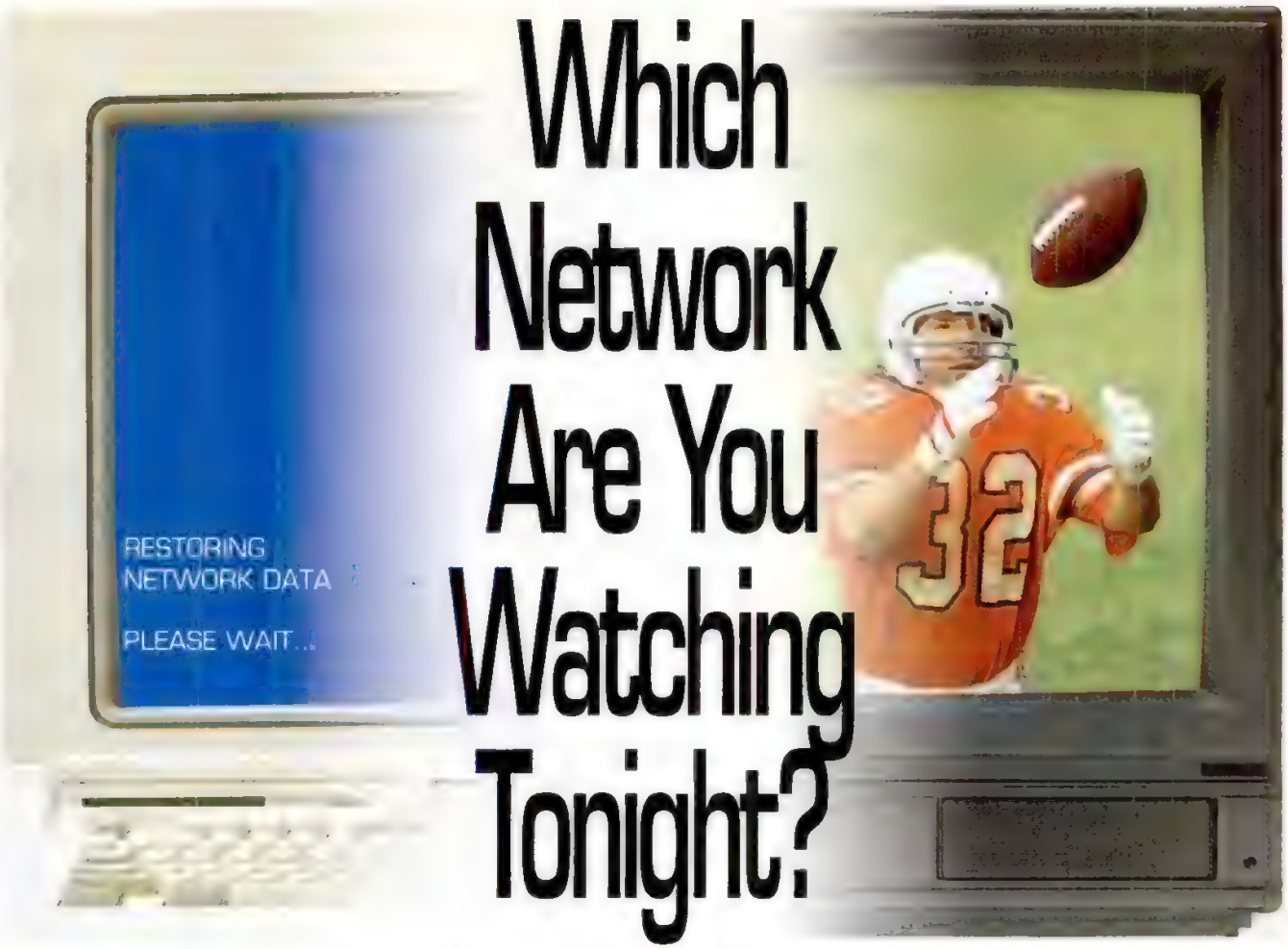
Northgate Power Plus 486 ZXP
Northgate Computer Systems Inc., 7075 Flying Cloud Dr., Eden Prairie, MN 55344; 800-548-1993.
List price (tested configuration): $3,899.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 64K cache.
Disk drives and controller: Maxtor 15-ms. 212MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, NEC 14-inch monitor.
Monitor refresh rate: 72 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 486 ON READER SERVICE CARD

TANGENT COMPUTER INC.

Tangent 433e

by Joe Desposito ■ With an excellent score on PC Magazine Labs' disk test and above-average scores on the others, the Tangent 433e is certainly a system to consider. But the scores don't tell the whole story: The 433e's swift performance on the disk test can be attributed to its caching controller, an advantage few other systems reviewed here have. On the other hand, the Tangent 433e's video card is



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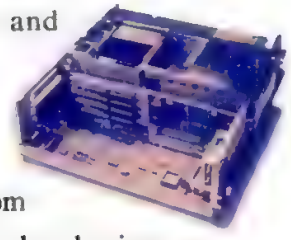

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CIRCLE 157 ON READER SERVICE CARD

optimized for GUI systems but was not tested under Microsoft Windows 3.0. Depending on the application you have in mind, actual video performance may be better than suggested by the test score.

This tower system, designed as a high-end workstation or file server, sells for $5,083 (our tested configuration costs $4,995). The Tangent 433e uses the new MNE-series Mylex motherboard. The board has eight EISA slots and holds up to 32MB RAM (using eight 4MB SIMMs). The 128K static RAM included with this system is the maximum amount you can place on the motherboard. Two chips on the motherboard from Dallas Semiconductor are noteworthy. One is a clock chip that provides the system time and date, and the other is a nonvolatile RAM module that stores setup and EISA configuration information. Neither chip requires an external battery.

Two add-in boards appreciably boost this system's performance. To achieve its stellar disk performance, the Tangent 433e uses a Mylex DCE 376 SCSI caching controller, which includes 4MB of 80-nanosecond RAM and an on-board processor. Drivers are included for MS-DOS, as well as AT&T, ISC, and SCO Unix, Version 3.2. A Quantum VGA card, which includes the S3 video chip, the Sierra HiColor RAMDAC chip, and 1MB RAM, provides fine Windows performance (Windows drivers are included).

With its caching controller, the Tangent 433e blew away the competition on our disk benchmark test. The system also scored above average on all the other tests. Keep in mind that the PC Labs' video test did not test the Quantum VGA card under Windows.

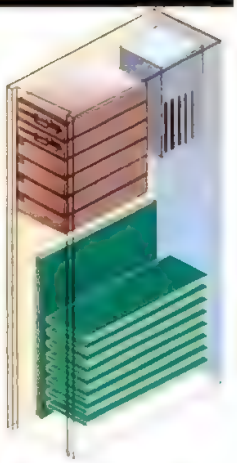
The standard tower chassis can accommodate up to six half-height 5.25-inch drives. The 300-watt power supply has only four device connectors, but the company supplies Y connectors upon request. Alternatively, Tangent offers a super tower case that has ten drive bays, a 450-watt power supply, an 1,100-watt uninterruptible power supply and three fans. The super tower case costs an additional $1,750.

The VGA card can deliver up to 1,024-by-768 resolution in noninterlaced mode at 70 Hz. This matches up well with the Sampo AlphaScan Plus multiscanning monitor included with the system. That monitor has a horizontal scanning range of 30 to 60 kHz and a vertical range of 50 to 90 Hz. If a 14-inch monitor doesn't suit your needs, the company sells a whole line of large-screen monitors.

The Tangent 433e comes with a one-year warranty on parts and labor that includes free on-site service from TRW—except for the keyboard and monitor, which the company will swap by mail. The Mylex caching controller has a two-year warranty.

With a 4MB caching controller and advanced video adapter, the Tangent 433e is targeted at the high-end workstation and file server markets. The Mylex caching controller is itself a reason to consider this system, especially if your application demands constant use of the hard disk.

FACT FILE
EDITORS' CHOICE

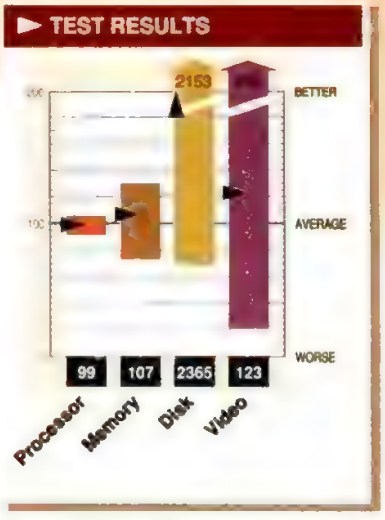


Tangent 433e
Tangent Computer Inc., 197 Airport Blvd., Burlingame, CA 94010; 800-223-6677, 415-342-9388.
List price (tested configuration): $4,995.
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 128K cache.
Disk drives and controller: Western Digital 14-ms. 210MB SCSI hard disk, Mylex controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Quantum 1,024-by-768 adapter with 1MB RAM, Sampo 14-inch monitor.
Monitor refresh rate: 45 to 90 Hz.
Software: DOS 5.0.

CIRCLE 489 ON READER SERVICE CARD

Tangent 433e

TEST RESULTS



In Short: The most obvious attribute of the Tangent 433e is its Mylex caching controller, which displayed exceptional performance on our disk benchmark test. Less obvious is the capability of the Quantum VGA board, which optimizes performance when used with a graphical user interface such as Microsoft Windows 3.0. This tower configuration is an excellent choice as a high-end workstation or file server.

TANGENT COMPUTER INC.

Tangent 433i

by Joe Desposito ■ An excellent video subsystem is the Tangent 433i's most notable feature. Marketed as a medium-range workstation, this mini-tower unit is aggressively priced at $3,183.

The mini-tower chassis, which has four drive bays, is well built with a steel brace on the left side for extra support. The power switch seems poorly made, however; the switch often sticks when you press it in. The Dash motherboard is partially obscured by the drive bays, making it difficult to insert or remove five of the ten static RAM cache chips (64K standard, expandable to 256K for an additional $125). The motherboard can hold up to 32MB of RAM, using 4MB SIMMs.

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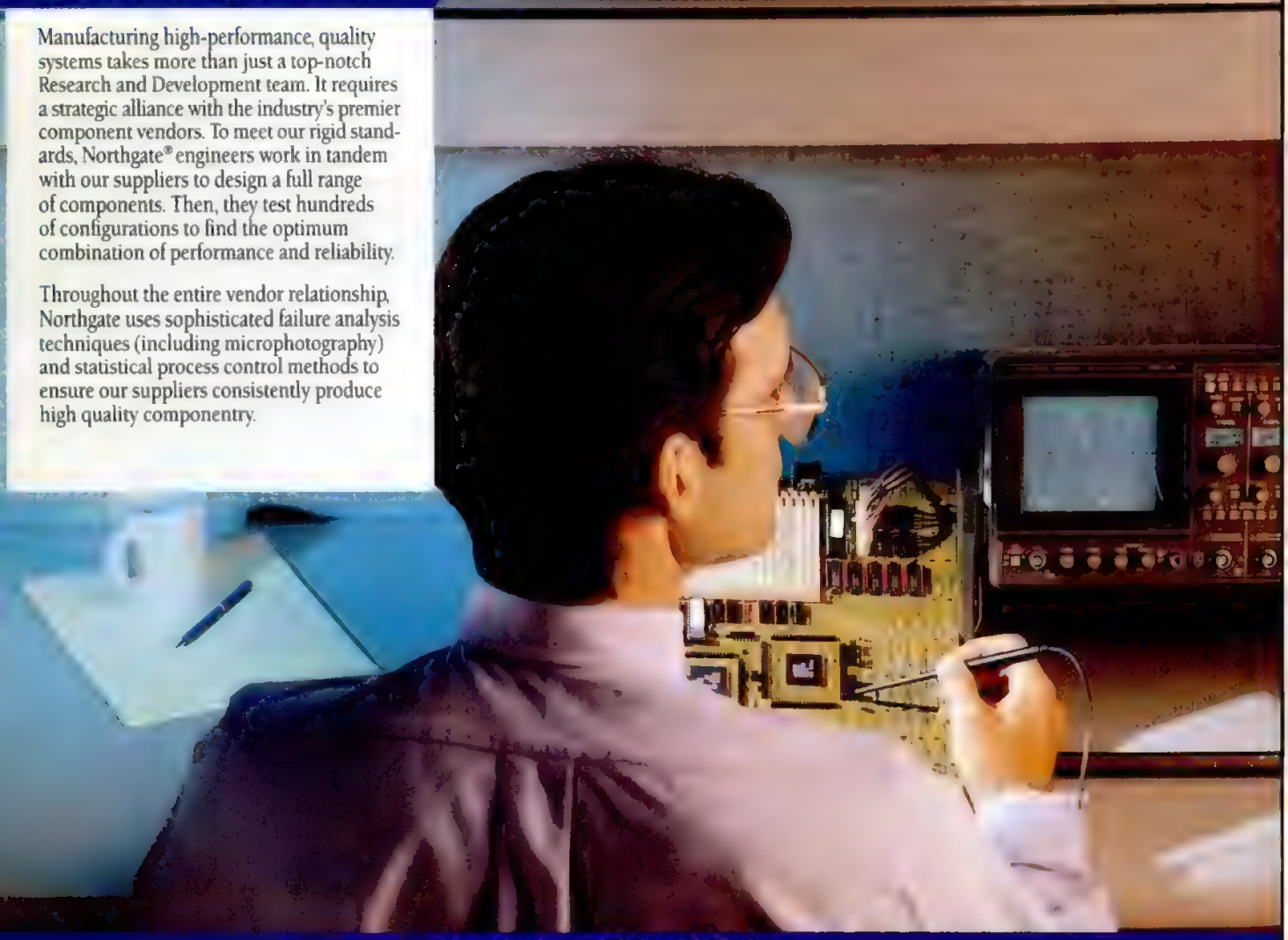

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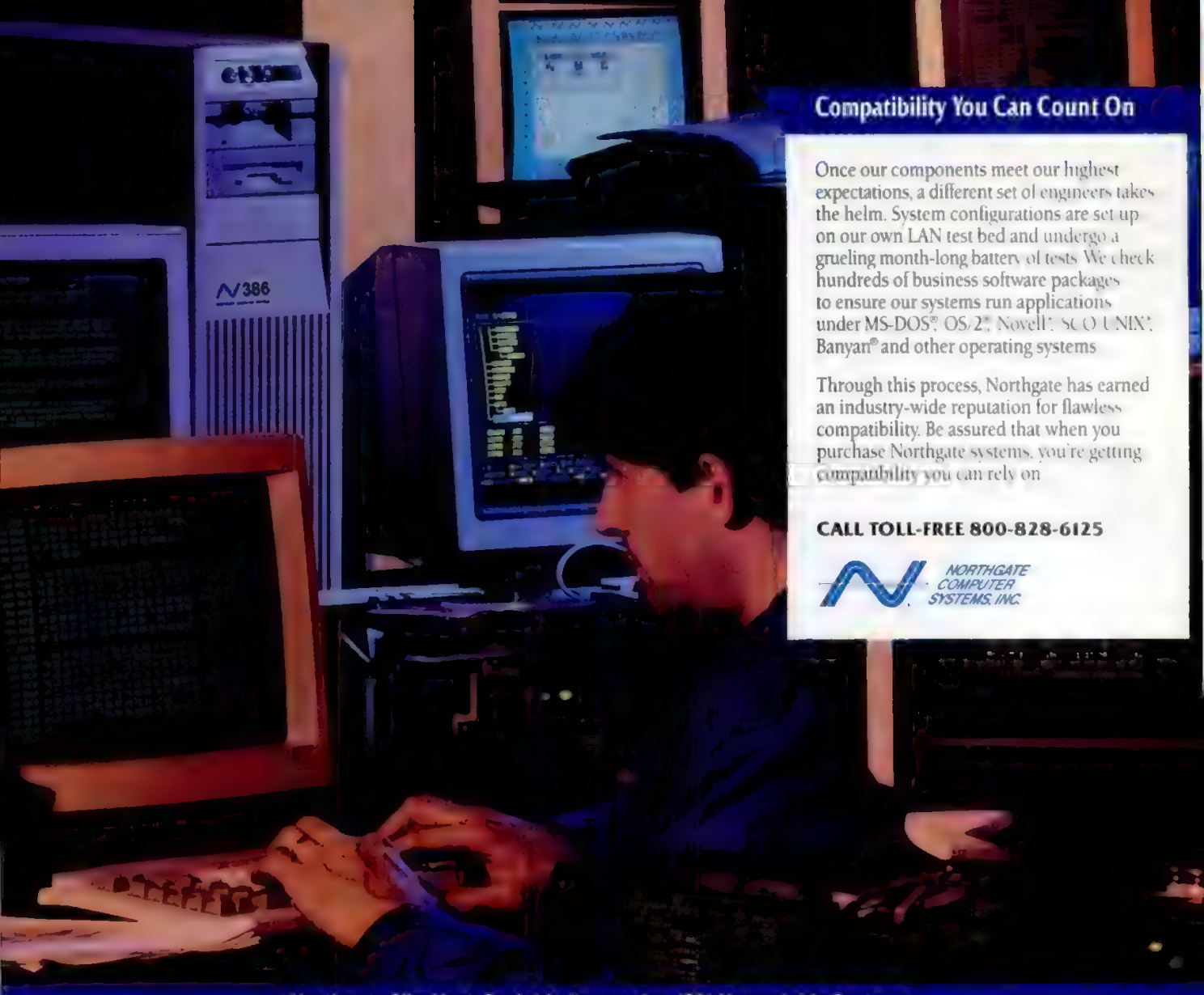

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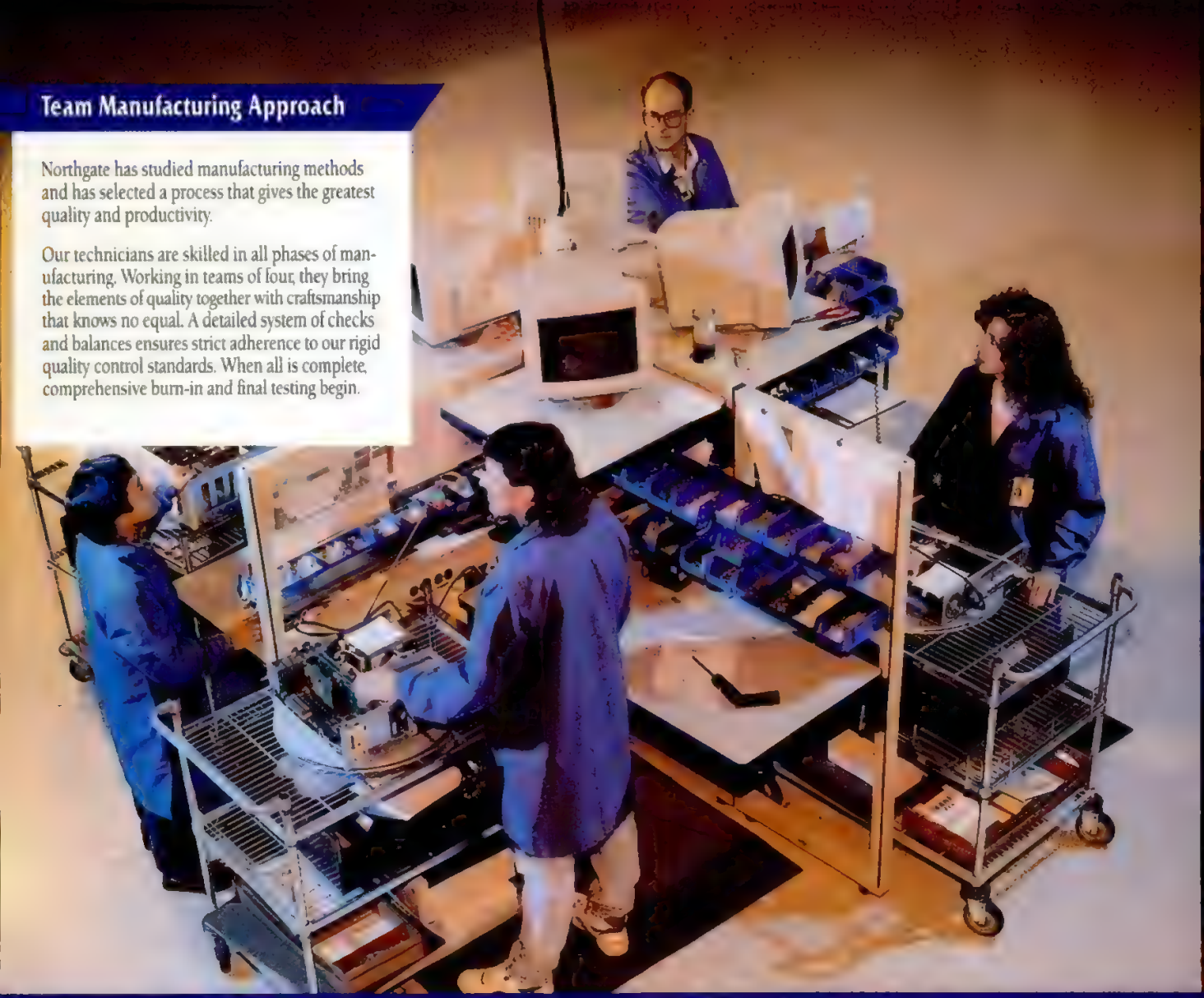

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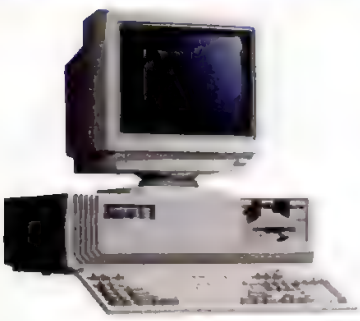

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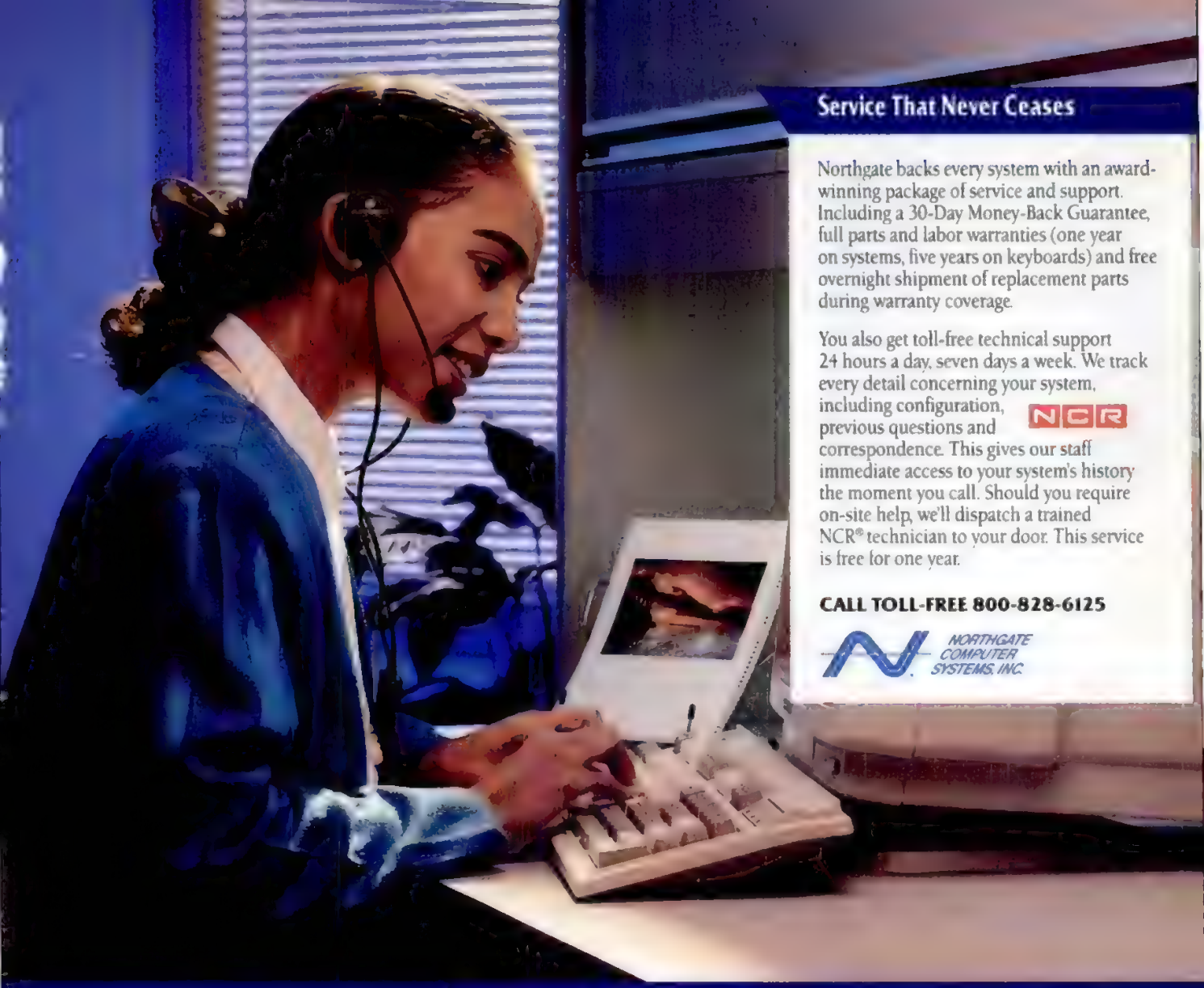

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If more RAM expansion is desired, a proprietary 32-bit slot on the motherboard accepts a 32MB memory card that costs $179. Eight 16-bit ISA expansion slots, an OPTi chip set, and an AMI BIOS are other significant features of the motherboard. The ROM-based system setup offers advanced as well as standard options. For example, in addition to shadowing the video and system BIOS, the system setup allows you to shadow the ROM of any other adapter board.

The video subsystem included with the Tangent 433i test system consists of the Quantum VGA card and Sampo AlphaScan Plus multiscan monitor. The Quantum VGA card can deliver a resolution as high as 1,024-by-768 in noninterlaced mode at 70 Hz. This matches up well with the monitor. The 14-inch Sampo monitor has a horizontal scanning range of 30 to 60 kHz and a vertical scanning range of 50 to 90 Hz. If a 14-inch monitor doesn't suit your needs, Tangent sells a whole line of monitors with larger screen sizes.

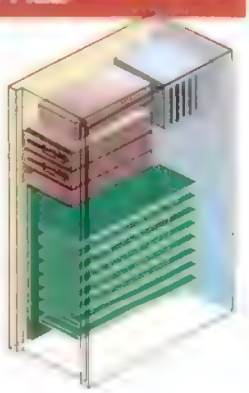
Test results for the Tangent 433i were about average, though PC Magazine Labs' video test did not test the system's video card under Microsoft Windows 3.0. The Quantum card, which incorporates the S3 graphics accelerator chip, is designed for optimum performance in systems that use a graphical user interface. The video card also includes 1MB RAM and a Sierra HiColor RAMDAC chip, which extends the number of colors available.

The Tangent 433i comes with a one-year warranty on parts and labor, which includes free on-site service from TRW. Tangent does not extend on-site service to the keyboard and monitor; instead, it swaps these items by mail if they are defective.

Tangent sells a competing 25-MHz ISA-bus model, but a company spokesperson said that the difference in price between the 25-MHz and 33-MHz models is minimal and that the 25-MHz models are being phased out.

As a medium-range workstation, the Tangent 433i offers capable performance at a great price. If you plan to work under Windows or some other graphical environment, you get the additional benefit of the S3 accelerator chip on the Actix video board.

FACT FILE

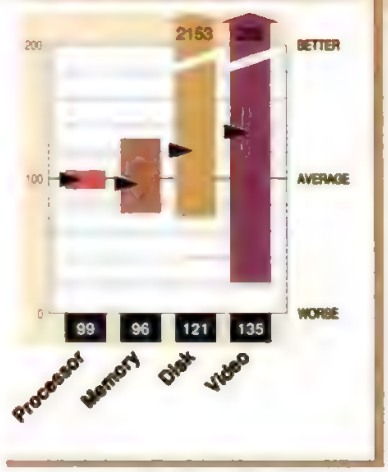


Tangent 433i
Tangent Computer Inc., 197 Airport Blvd., Burlingame, CA 94010; 800-223-6677, 415-342-9388.
List price (tested configuration): $3,183.
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 64K cache.
Disk drives and controller: Western Digital 14-ms. 210MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Quantum 1,024-by-768 adapter with 1MB RAM, Sampo 14-inch monitor.
Monitor refresh rate: 45 to 90 Hz.
Software: DOS 5.0.

CIRCLE 483 ON READER SERVICE CARD

Tangent 433i

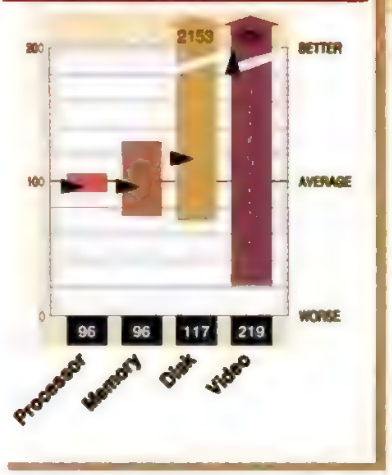
TEST RESULTS



In Short: Aggressively priced at $3,183, the Tangent 433i performed about average in all areas. However, PC Magazine Labs' video test did not test the system's Actix video card under Microsoft Windows 3.0. The video card, which bears the S3 graphics accelerator chip, is designed for optimum performance in systems that use a graphical user interface. This is a capable system at an affordable price.

Tri-Star Flash Cache 486 EISA

TEST RESULTS



In Short: A better-than-average disk benchmark test score and a fast video time were balanced by otherwise average test scores from the 486 EISA tower Tri-Star Flash Cache 486 EISA. An Ultrastor 24F caching SCSI disk controller helped its disk performance. Nevertheless, a copious expansion capacity—four accessible full-height drive bays and room for two full-height hard disks—takes this erstwhile workstation into network territory.

TRI-STAR COMPUTER CORP.

Tri-Star Flash Cache 486 EISA

by Tom Unger ■ Tri-Star Computer Corp.'s Tri-Star Flash Cache 486 EISA is representative of a growing number of relatively inexpensive tower systems. At $3,795 ($4,590 for the tested configuration), the Flash is priced within the range of most 486 EISA workstations in its basic configuration but nevertheless competes as a server for small to

medium-size networks. Its copious expansion capacity, solid metal-chassis construction, and quality components ultimately outweigh some performance and layout oddities.

Our $4,590 test unit came with a 330MB Maxtor hard disk and UltraStor Ultra 24F SCSI drive controller combination, and its DOS File Access test result was somewhat better than average. On the other hand, the Diamond SpeedSTAR Hi-Color Super VGA card turned in one of the fastest Direct to Screen scores in our roundup, second only to the Everex STEP 486/33. The Hi-Color controller comes with 1MB RAM and employs a Tseng/Sierra chip set. Coupled with a Tri-Star 5217 17-inch flat-screen monitor on our test system (an extra $595 over the $3,795 system price), this produced truly superior video for the Flash. The basic system comes with the same video controller, but with a MAG Computronic 14-inch Super VGA monitor instead.

ROOMY CASE

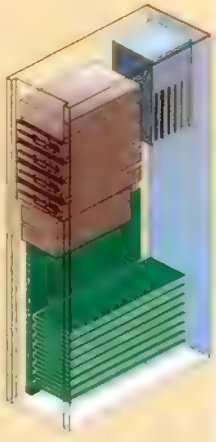
Most impressive is the Flash's expansion capacity. Its all-metal tower case offers room for as many as eight drives—including four that are accessible from the front of the case. In our test unit, the Maxtor hard disk filled the larger internal slot; a 3.5-inch and a 5.25-inch floppy disk drive filled two of the accessible bays. This still left enough room for a tape backup unit, a CD-ROM drive, and one high-capacity 3.5-inch hard disk. In case that much expansion does not prove enough, the UltraStor SCSI controller has a SCSI-2 port that will allow the user to daisy-chain up to seven external devices as needed.

The Tri-Star Flash Cache 486 EISA's Free Technologies motherboard comes with 8MB RAM standard and a 256K processor RAM cache, and leaves room for up to 64MB of SIMM-based, 70-nanosecond RAM. In addition to six 32-bit EISA expansion slots (one of which was filled by the UltraStor hard disk controller), the motherboard contains two 16-bit ISA slots. One of the Flash's 16-bit slots was used by the Super VGA controller card, and the other by an I/O card that provided one parallel port, two serial ports, and one game port.

Tri-Star, which sells direct to end users, offers a standard 24-month parts-and-labor warranty with on-site service free from TRW for 12 months. Tri-Star operates a toll-free technical support line and, through TRW, will ensure that dead parts are replaced within 48 hours. Should you wish to upgrade, Tri-Star offers components too numerous to list here, including video accelerator cards and 660MB and 1.2GB hard disks.

With its decent hard disk performance, the tower-style Tri-Star Flash Cache 486 EISA provides a mix of quality components at a reasonable cost. Its price of $3,795 for a system with a 200MB SCSI hard disk and fast Super VGA subsystem makes it worth a look.

FACT FILE



Tri-Star Flash Cache 486 EISA
Tri-Star Computer Corp., 120 S Weber Dr., Chandler, AZ 85226, 800-678-2799.
List price (tested configuration): $4,590
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 256K cache
Disk drives and controller: Maxtor 16 ms 330MB SCSI hard disk, UltraStor controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Tri-Star 17-inch monitor.
Monitor refresh rate: 50 to 90 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 501 ON READER SERVICE CARD

TWINHEAD CORP.

Twinhead Superset 600/433C

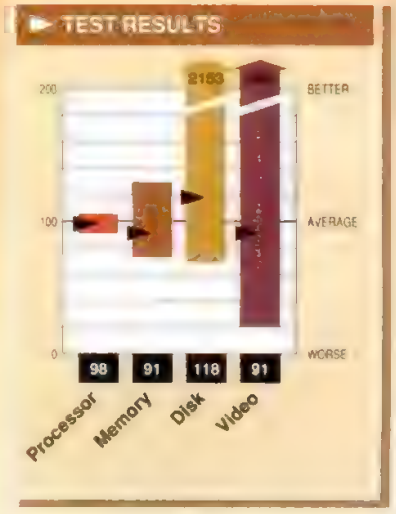
by Winn L. Rosch■Compact and powerful, the Twinhead Superset 600/433C, from Twinhead Corp., keeps up with the fastest systems despite its diminutive size; it is packed into a small-footprint case measuring 5.5 by 15.5 by 15.5 inches. This system, however, falls short in its video performance and its expansion possibilities.

A bigger penalty is price. At $5,079 in the configuration requested for this review, the Superset rates as fairly expensive for a limited-expansion system.

The Superset is actually the top of a two-step upgradable line that starts with a 33-MHz 386. Sockets on the system board accommodate a 486 or a 386 and your choice of coprocessor for the latter—either an Intel 387 or a Weitek 3167. No provision is made for a 4167 coprocessor.

These sockets, located in the front-left

Twinhead Superset 600/433C



In Short: The Twinhead Superset 600/433C is a 486/33-based small-footprint PC with limited expansion. It has three usable full-size AT expansion slots and one free half-height 5.25-inch drive bay. (If you install two floppy disk drives, only one internal and one external drive bay are left.) This PC was a decent performer except for a laggardly video speed, but it is also somewhat pricey when compared with the rest of the field.

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You can see the difference between 1-2-3 for Windows and Microsoft Excel in a matter of seconds.

BENCHMARKS — **INFO WORLD**

September 9, 1991

Windows Spreadsheets

	Microsoft Excel Version 3.0	Lotus® 1-2-3® for Windows™ Version 1.0
CALCULATION (all times in seconds)		
Arithmatic model		
Recalc partial	<1	2.5
Recalc all	1.6	4.3
File load	6.9	10.5 – 12.2
File size (in bytes)	243,644	219,258
Financial model		
Recalc all	11.4	34.9
Scientific model		
Recalc all	3.7	10.0
CONSOLIDATION		
Page-oriented model	5.0	<1
File-oriented model	<1	1.3

Tests performed on a COMPAQ DESKPRO 386/20e™ with 4 megabytes of RAM and 110-megabyte hard drive
Times given as ranges reflect when cursor control was returned and when the recalculation was completed

Microsoft Excel is over two times faster than 1-2-3 for Windows by virtually every measure.

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corner of the chassis, are easily accessible. Located just behind them is the standard 64K static RAM cache, based on an Intel cache controller on a plug-in daughterboard, and behind that are the eight SIMM sockets that hold all memory. The Superset comes standard with four 1MB SIMMs, and loading the others similarly with 80-nanosecond SIMMs brought the evaluation unit to the requested configuration. These sockets also hold 4MB SIMMs, allowing up to 32MB of RAM on the system board. Otherwise, the motherboard is somewhat limited: Only three of its four slots can hold full-size AT expansion boards using the system's 16-bit ISA bus.

The equally modest mass-storage accommodations consist of four drive bays: three accessible and one internal. The internal bay houses a 1.7-inch-tall 3.5-inch hard disk. Twinhead's most popular drive is the 200MB Conner CP3204F (included in the evaluation machine), which plugs into the defeatable IDE port on the system board. Two 1-inch-high 3.5-inch bays, used for floppy disk drives, mount without tools on snap-in rails. A 5.25-inch bay lies under the floppy disk drives.

All I/O functions, including floppy disk control, one parallel and two serial ports, and video are integrated into the motherboard, leaving free all four expansion slots, which extend horizontally from a T-bar. The height of the system's SIMMs, however, interfere with the bottommost slot. The biggest downfall of such integration is the Trident VGA chip, which held back the Superset's video speed.

A DIP switch and jumpers augment the setup program in the Award BIOS. Twinhead documents all the settings on a label affixed inside the lid of the case, a convenient touch for those who cannot bring themselves to deal with manuals.

The construction of the Superset is very good, with a robust steel case and unblemished workmanship on a system board that is based primarily on Intel VLSI chips. Backed with one-year of on-site service from TRW, the Superset is what you should expect from Taiwan's fifth-largest personal computer maker. If you don't need a lot of expansion space, the Twinhead Superset 600/433C is a good if somewhat pricey alternative.

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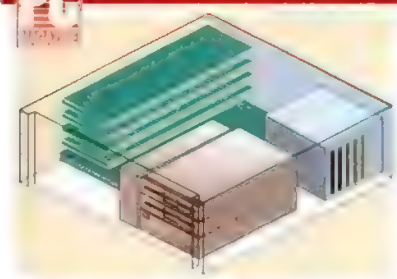


Twinhead Superset 600/433C
Twinhead Corp., 1537 Centre Point Dr., Milpitas, CA 95035; 800-545-8946, 408-945-0808.
List price (tested configuration): $5,079.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 64K cache.
Disk drives and controller: Conner 19-ms. 200MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Trident Super VGA adapter with 512K RAM, Relysis 14-inch monitor.
Monitor refresh rate: 70 Hz.
Software: DOS 5.0.

CIRCLE 483 ON READER SERVICE CARD

eight SIMMs each. When you add RAM modules equally to each bank, the system is capable of a 64-bit data bus burst. There is no external static RAM cache; instead the system uses a secondary eight-level write buffer.

The Z-649 TIGA video card included with the Z-486/33E has a VGA daughterboard connected to it. With this setup, you may operate in standard VGA or TIGA mode. The TIGA board uses the Texas Instruments TMS34010 graphics coprocessor running at 60 MHz for advanced graphics performance. Unlike the S3 graphics accelerator chip, however, this graphics coprocessor also enhances such applications as *AutoCAD*, as well as Microsoft Windows 3.0. (TIGA drivers for Windows are installed on the hard disk by Zenith.) The best resolution available with the TIGA board is 1,024-by-768 in noninterlaced mode. The board comes standard with 512K RAM, which pro-

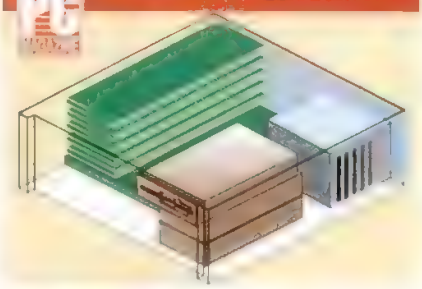
ZENITH DATA SYSTEMS

Zenith Z-486/33E

by Joe Desposito■Zenith Data Systems' Z-486/33E has several notable features: an EISA bus, innovative memory design, TIGA video, a small footprint, and quality construction. Though not a performance leader, the system performed adequately on PC Magazine Labs' suite of tests. Marketed by Zenith as a graphics workstation, the Z-486/33E has a suggested retail price of $10,997 for the configuration tested.

The five EISA slots of the system reside on a card that connects vertically to the Zenith motherboard. Therefore, ISA and EISA expansion cards are mounted horizontally (T-bar design). All RAM (up to 64MB) resides on a memory card. The card has two banks that can hold up to

FACT FILE



Zenith Z-486/33E
Zenith Data Systems, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331.
List price (tested configuration): $10,997.
Memory and processor RAM cache: 8MB 80-ns. SIMMs.
Disk drives and controller: Western Digital 15-ms. 200MB IDE hard disk, 1.44MB floppy disk drive.
Display: Zenith 1,024-by-768 adapter with 512K RAM, Zenith 15-inch monitor.
Monitor refresh rate: 60 to 70 Hz.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 503 ON READER SERVICE CARD

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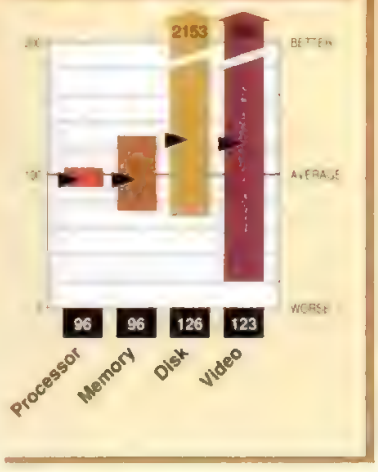
Zenith Z-486/33E

TEST RESULTS



In Short: The small-footprint Zenith Z-486/33E uses a T-bar design for EISA expansion cards. All RAM (up to 64MB) resides on a proprietary memory card; there is no external static RAM cache. The system performed about average on all of PC Magazine Labs' benchmark tests. The video test, however, does not reflect the performance of the system's TMS34010-based TIGA video card running graphics software.

The Z-486/33E scored close to the average on each of PC Magazine Labs' tests. Note that performance on the memory test was not adversely affected by the lack of an external static RAM cache. Also, keep in mind that the video test does not reflect the performance of the TIGA board operating in a graphical environment such as Windows or with graphics packages such as *AutoCAD*.

The Z-486/33E bears the standard one-year warranty, with on-site service for an extra $80 during the warranty period. Though Zenith lacks a technical support line, it does have an active CompuServe forum in which members of the company's technical staff participate.

The Zenith Z-486/33E is a nicely designed system with average performance. Keep it in mind, especially if you are interested in a small-footprint graphics workstation that uses the TIGA standard.

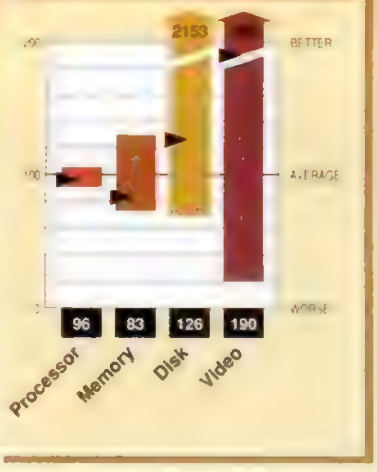
vides 16 colors at this resolution. To get 256 colors, you must add another 512K RAM at a cost of $259.

Zenith includes the high-performance 15-inch ZCM 1650 monitor (which has a $1,700 price tag) with the Z-486/33E. The monitor is capable of noninterlaced 1,280-by-1,024 resolution at 70 Hz. With the supplied video card, however, you are limited to either standard VGA or noninterlaced 1,024-by-768 resolution at 60 Hz (TIGA mode). The Z-486/33E has a standard 15-pin connector, and the monitor has BNC connectors for separate red, green, and blue inputs. Separate inputs may be useful with other kinds of video applications, but the TIGA card cannot use them. In addition, Zenith does not have a less costly alternative to the ZCM 1650 that supports TIGA mode.

The Z-486/33E is solidly built. Metal plates 6 inches high by 14 inches wide at the front and rear of the small-footprint chassis are connected down the center by a 3-inch-deep metal brace. Both the EISA expansion adapter and memory card are fastened to the brace.

Zeos 486-33

TEST RESULTS



In Short: The Zeos 486-33 combines a competitive price with some technically attractive features, plus an arm-long collection of extras into the bargain. It includes a modular CPU design, a video system that performed well on our test, lots of expansion space, and plenty of options. This is a strong product, and is worthy of consideration if you are looking to buy a 486/33 system.

ZEOS INTERNATIONAL LTD.

Zeos 486-33

by Alfred Poor ■ Some companies compete on price, some on features, and some on technological design. Zeos International's Zeos 486-33 takes its best shot in all three arenas, and its aim looks pretty good. Our ISA test system's list price of $3,545 holds its own with any of the lower-priced systems in this review, without compromising on a low-ball design.

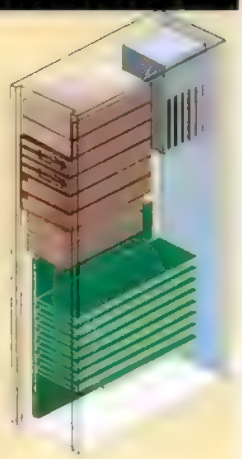
The familiar tower case, priced at $150 more than the standard desktop case,

contains a 300-watt power supply and a motherboard designed for modular CPUs. (Zeos also offers 386/25, 386/33, and 486SX/20 modules.) These modules are also socketed for a 128K external system cache memory board, list-priced at an additional $200. The Zeos 486-33 also comes with the Diamond Hi-Color Super VGA display adapter, which has earned a reputation as one of the fastest cards for DOS applications and shows it on PC Magazine Labs' video benchmark test. It is paired with a 14-inch color monitor to give a 1,024-by-768 noninterlaced high-resolution display.

This design performed well on our tests, but aside from the video result, the speed was comparable with the rest of the models in its class. Note that our test system did not include the optional system cache.

If you prefer to compare on the basis of features, the Zeos 486-33 should satisfy the most demanding checklist adherents. You get both sizes of high-density floppy disk drives and a full 8MB of memory with the standard package. You get a

FACT FILE
EDITORS' CHOICE



Zeos 486-33
Zeos International Ltd., 530 Fifth Ave. NW, St. Paul, MN 55112, 800-423-5891, 612 633-4591
List price (tested configuration): $3,545
Memory and processor RAM cache: 8MB 53-ns SIMMs
Disk drives and controller: Western Digital 16-ms, 200MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Zeos 14-inch monitor
Monitor refresh rate: 60 Hz
Software: DOS 5.0, Microsoft Windows 3.0, *Ami Pro, Lotus 1-2-3 for Windows*

CIRCLE 504 ON READER SERVICE CARD

choice of DOS 4.01 or DOS 5.0, and you get Microsoft Windows 3.0 and a Microsoft mouse. You get a handful of cables, adapters, and extenders so you can hook up everything. Zeos adds *Ami Pro* and *Lotus 1-2-3 for Windows* as a bonus.

PORTS ON THE MOTHERBOARD

If you don't like one part or another of the standard package, Zeos offers pages of options, including 42MB to 1.1GB hard disks, tape backups, modems, monitors, and even printers. There's room for expansion with all ports and interfaces, except for video on the motherboard. This means that all but one of the eight ISA slots (seven 16-bit, one 8-bit) are open in the *PC Magazine* configuration. And the optional tower case leaves space for nine half-height storage devices.

Zeos provides the finishing touch with 24-hour technical support on a toll-free line, a one-year parts-and-labor warranty, and extended service contracts costing $49 for the first year and 10 percent of the system price for each of the next three years.

The Zeos 486-33 represents an attractive bargain if you are in the market for top-speed performance at an affordable price. No matter what your selection criteria may be, this is a computer that should be on your final list. ■

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© 1991, 1992 Qualitas. Qualitas, 7101 Wisconsin Avenue, Suite 1386, Bethesda, MD 20814. *All company and product names are trademarks or registered trademarks of their respective owners.* **System Requirements: Any 386 or 486 PC or PS/2, min. 256K of extended memory, DOS 3.0 or higher, and hard disk drive.** **386MAX supports 286 systems with Shadow RAM. Feature availability and memory recovery may vary. ***Offer valid in North America only.*

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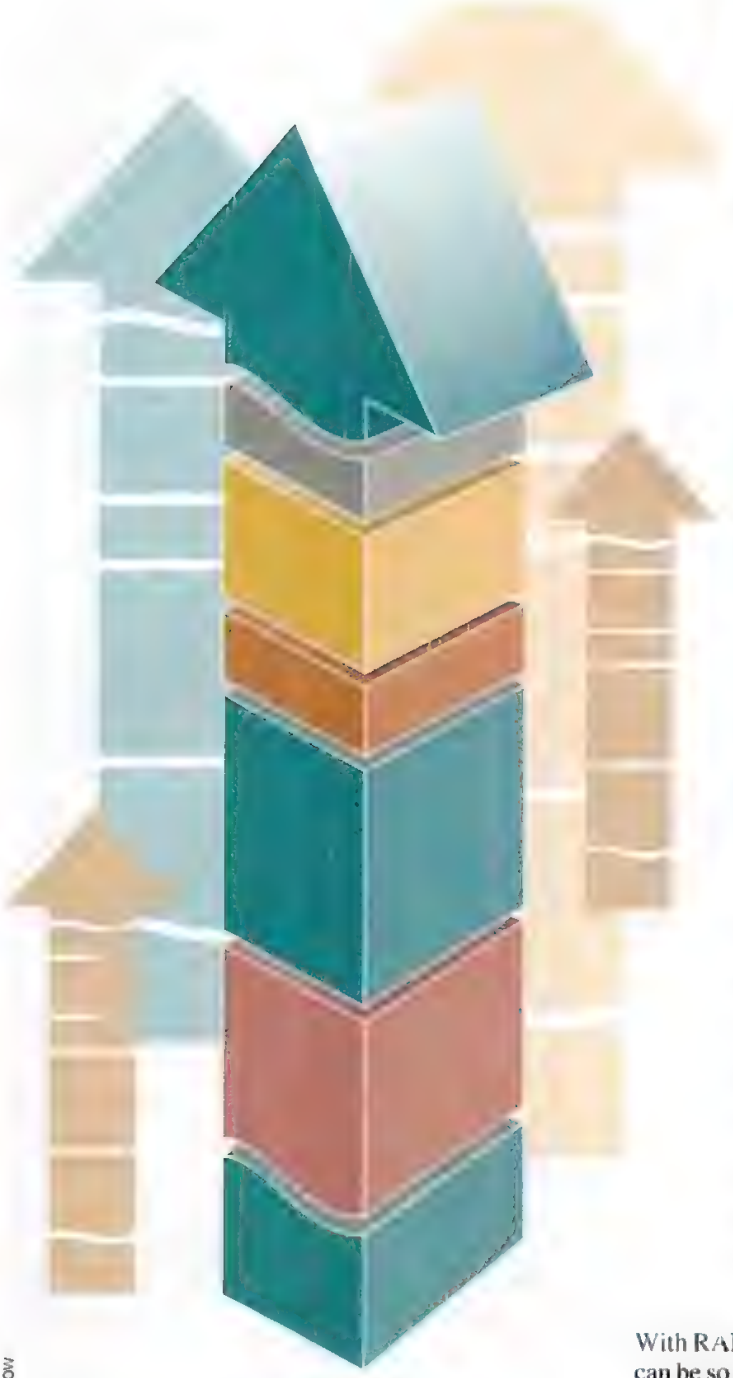


GRAPHIC ILLUSTRATION GARY W. KAPLOW

Nine Memory Managers Open Up New Frontiers

By Barry Simon

Despite improved installation and optimization routines, these nine 386 memory managers remain tricky to understand and use well. Knowing what you want to accomplish before you start can be a big help.

With RAM prices now under $50 per megabyte, upgrading your system can be so inexpensive that your only question may be what to do with all of the extra memory. If you're using Microsoft Windows or OS/2, you know that you need all of the memory you can get, but DOS users shouldn't hold back either. If you have a 386 or 486 system, more memory and a memory manager carefully installed and optimized can help you use your system more productively.

In this evaluation, we review seven such utilities—*ATLast!*, *DOS 5 Memory Management Kit*, *Memory Commander*, *Netroom*, *QEMM-386*, *QMAPS*, and *386-MAX*—as well as the memory management capabilities built into MS-DOS, Version 5.0, and DR DOS, Version 6.0.

MEMORY MANAGEMENT: Defining the Terms

conventional memory Base memory up to 640K.

device driver A program used to set up software or to control hardware. It is installed with a DEVICE= directive in your CONFIG.SYS file.

DOS extender Software that lets programs run in extended memory.

DOS/Protected-Mode Interface (DPMI) A specification introduced with Microsoft Windows 3.0 that allows DOS programs to access more than 640K by using the protected mode of a 286, 386, or 486 machine.

expanded memory (EMS) RAM available through a bank-switching scheme, defined in the Lotus/Intel/Microsoft expanded memory specification (LIM EMS). Expanded memory is generally used only to open large data files.

extended memory The memory above 1MB in a PC that is not configured for expanded memory. It can be used only by a 286, 386, or 486 processor running in protected mode. Extended memory was introduced on the IBM AT in 1984 but was initially used only for RAM disks. In recent years, Microsoft Corp.'s extended memory specification (XMS), which was first developed for Microsoft Windows 2.1, has become the preferred way to use extended memory.

high memory area (HMA) The first 64K of extended memory. It is used by Windows' HIMEM.SYS as the place where extended memory is managed.

memory blocks Memory areas set aside by DOS.

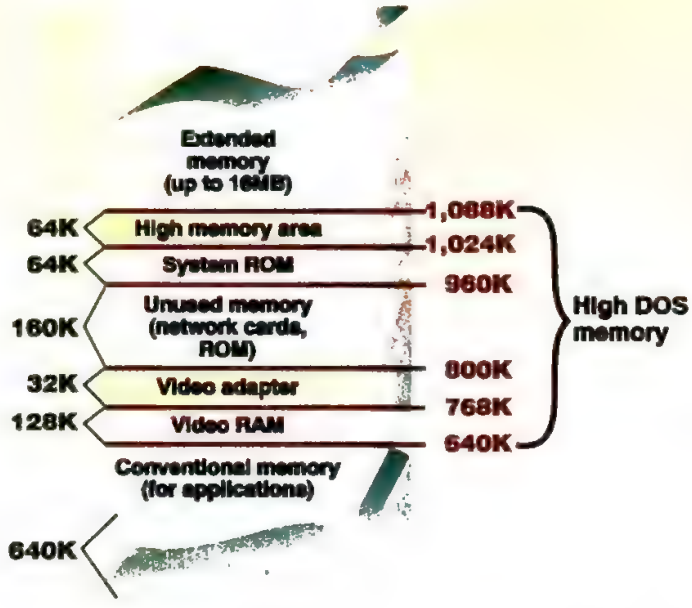
upper memory block (UMB) A section of memory in the high DOS area (the 384K address space between 640K and 1MB). Some such blocks are used to store BIOS code, and some are free.

Virtual Control Program Interface (VCPI) One of three schemes (along with DPMI and XMS) used for accessing protected memory. The specification allows multiple real-mode programs to share expanded memory, and it lets multiple DOS-extended programs run simultaneously in 386 machines.

A TYPICAL MEMORY MAP

Memory management software strives to utilize the free areas of memory for storing small programs (such as TSRs and drivers) so that more space is available for applications and data in the first 640K of DOS.

Memory managers must establish a link between programs in the high memory area (HMA) and the portion of DOS that runs in the first 640K. For example, DOS 5.0 installs HIMEM.SYS in HMA to act as a link between lower memory and programs stored in the upper memory block (UMB).



IS MS-DOS 5.0 ENOUGH?

Before you even take a look at the seven standalone programs, it's important to remember that some memory management capabilities are now included with DOS, and those abilities have changed the way users and vendors view their programs. Since DOS 5 arrived last June, memory management vendors have scrambled to present user-friendly solutions that go far beyond DOS's capabilities, and in most cases they've succeeded. These days you have a wide field of choices to ponder.

It's important to remember that some memory management capabilities are now included with DOS.

Memory packages typically manage space in three ways: by moving drivers and TSRs that normally devour precious memory from the 640K of conventional memory area into unused address space, by controlling extended and expanded memory, and under some circumstances by utilizing memory above 640K.

Generally, if you have simple computing needs and like the idea of having a little more space with which to work, you can get by with MS-DOS's features. But if you're a power user, a Windows user, or a terminate-and-stay-resident program (TSR) junkie, you will want the many benefits that the more sophisticated memory management utilities offer.

Understanding memory management, the benefits it offers, and the abilities already incorporated into DOS will help you decide if you need a standalone memory manager.

TAKING THE HIGH ROAD

The 8088 chip that powered the original PC is capable of addressing a full megabyte of memory (1,024K). The designers of MS-DOS, Version 1.0, arbitrarily divided that first megabyte of memory into 640K RAM for the operating system and applications and 384K reserved for hard-

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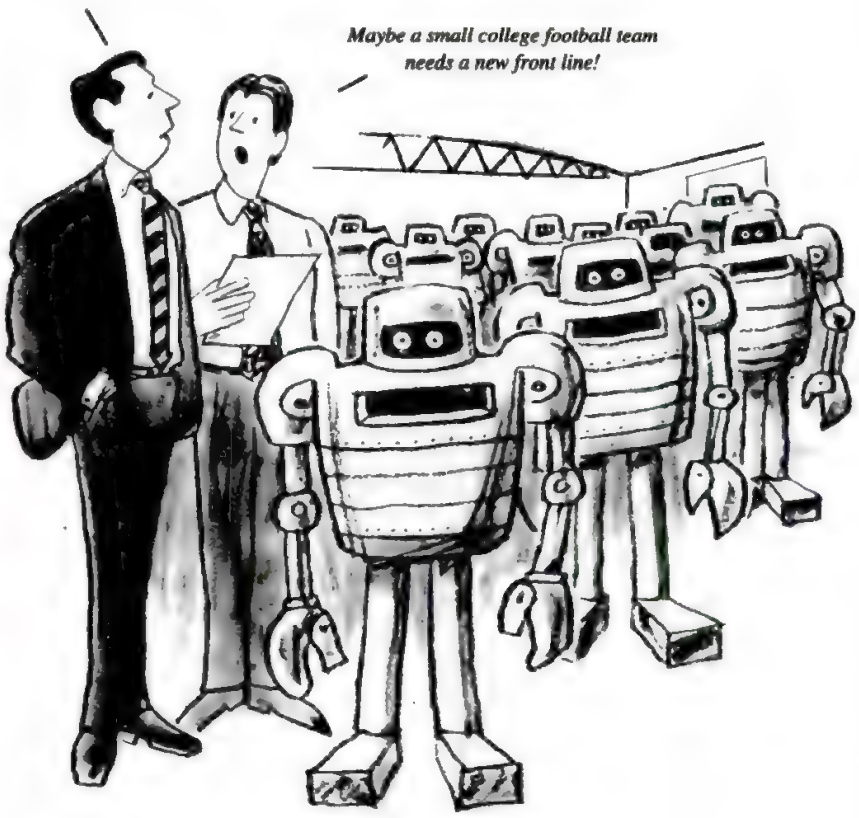

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ware. Some of that 384K remains unused; 128K is earmarked for video RAM, but on most systems, at least 32K of that will remain empty. Typically, system ROM takes 64K (128K on PS/2s), and video adapters take 32K ROM.

The bottom line is that a typical system—a non-PS/2 environment with EGA/VGA and no additional ROM adapter—will have as much as 192K of high memory sitting unused. To access expanded memory (EMS), a memory manager needs to take 64K of that address space for the EMS page frame. That's where the magic memory management capabilities of the 386 chip comes in. The chip can be programmed by a memory manager to remap memory addresses and move extended memory into the unused nooks and crannies between 640K and 1MB. You can then use the memory manager to load drivers and TSRs into these high areas, which are called upper memory blocks (UMBs).

MEMORY MENAGERIE

Getting around the 640K limitation has produced an alphabet soup of memory types and standards. The raw memory in your machine beyond 1MB is called extended memory. When Microsoft introduced Windows, Version 2.10, it devised an extended memory specification known as XMS. DOS 5.0 uses the driver HIMEM.SYS to communicate with the first 64K of the XMS region, called the high memory area (HMA); with HIMEM.SYS installed, DOS 5.0 is able to store much of its kernel and DOS buffers. Most memory managers provide an alternative to HIMEM.SYS.

Some applications—most notably *Lotus 1-2-3*, Release 3.*x*, and some versions of *AutoCAD*—are able to escape the 640K barrier by running in protected mode, but you can't have multiple protected-mode programs running unless they have a method of communicating. The specification used by most of these programs is called the Virtual Control Program Interface (VCPI). All memory managers provide VCPI support. Some also offer the DOS/Protected-Mode Interface (DPMI), a more recent specification. Windows 3.0 adheres to DPMI but not the VCPI specification.

Another part of memory these programs manage is expanded memory, controlled by the EMS spec, which requires a 64K *frame* in the UMB area. DOS 5.0 uses a driver called EMS386.SYS to provide EMS support and UMB support.

One advantage memory managers with integrated XMS/EMS drivers have is the ability to convert one type of memory to another on the fly so that you could, for example, load *Lotus 1-2-3*, Release 2.3, use EMS memory for your spreadsheet, exit the program, and load Windows using the same memory treated as XMS.

With DOS (including Version 5.0), you need to change your CONFIG.SYS file and reboot to change from one use of memory to the other. Currently, *Netroom*, *QEMM-386*, *QMAPS*, and *386MAX* provide such automatic conversion of XMS to EMS.

A LONGER ADDRESS

Since DOS requires its address space to be in one contiguous chunk, the 64K immediately above the 640K barrier is used by EGA/VGA in high-resolution graphics mode. Unlike MS-DOS (including Version 5.0) or DR DOS (including Version 6.0), memory managers allow you to break the 640K barrier by as much as 96K as long as you use a monochrome monitor or avoid graphics.

HOW MUCH MORE MEMORY CAN YOU EXPECT?

by Barry Simon

In the competitive and arcane world of memory management, vendors often say, "We deliver more memory." But the claims they make are often based on very specific configurations and implementations of their products. It's hard to tell if you'll get the same result.

How do you figure out which product will deliver the most memory for you? Start with an analysis of your needs. *PC Magazine* provides test results based on typical machines, but your system is probably very different.

If you want to try and compare memory usage among memory management utilities, you'll need to do some paper-and-pencil work. First, figure out how much memory your TSRs and drivers use. System-reporting utilities such as Quarterdeck's *Manifest* are useful for finding these numbers ("System Setup: The Inside Story," March 26, 1991). DOS 5's MEM/C command will also give you this information.

Next, you'll need to determine which areas of the DOS upper memory block (UMB) are used by your hardware's ROM BIOS and whether the memory manager you are considering can recover any of that space. This can be tricky. For example, in an attempt at AT compatibility, some older Compaq Deskpro 386s duplicate ROM BIOS addresses in the *E* region. On such machines, you need to check whether or not the managers you are considering can fix and recover the *E* region. Some AST and Olivetti machines also cause problems when you attempt to recover the UMB areas. MS-DOS 5.0, for example, cannot remap the BIOS in those areas on those machines, while *QEMM-386* and *386MAX* can. The manufacturer of the software should be able to tell you whether or not your machine is supported.

Finally, you should decide whether you need the expanded memory page frame. If you are running programs that use EMS, you will. If you don't use any EMS software, you can save memory by not opening the page frame. This page frame issue is important not only because the page frame consumes 64K of the UMB region, but also because features like *QEMM-386*'s Stealth and *386MAX*'s FlexFrame need a page frame to operate.

With those facts in hand, you should be able to figure out how much UMB space can be made available in your machine and determine if it is enough to handle your TSR programs and drivers. Unfortunately, merely discovering that the space your TSRs and drivers take is less than your free UMB space won't give you an exact prediction of how much memory you'll recover because these memory managers may require extra memory while loading, or the UMB region may be fragmented. Nevertheless, analyzing your own memory needs before you buy a memory manager will make you a smarter shopper. ■

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MEMORY MANAGEMENT SOFTWARE SUITABILITY TO TASK

We rated the nine memory management packages in this review on their ability to accomplish each of the five following tasks. The scores point out big differences among the products, so it's best that you know what your memory management needs are before you buy.

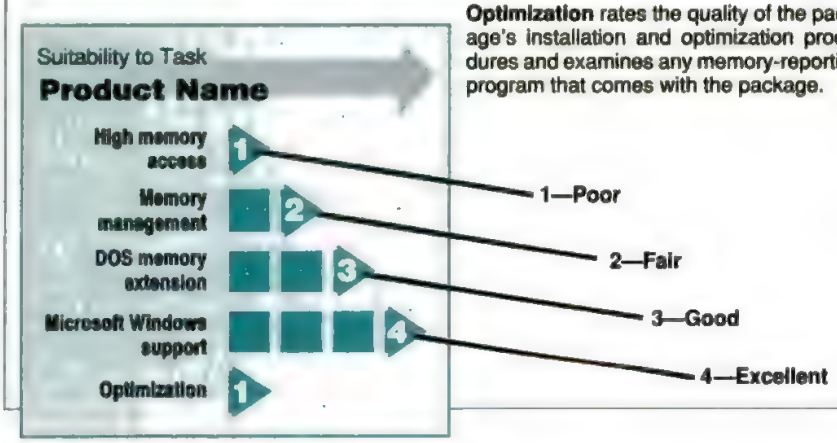
High memory access rates the program's ability to provide memory in the 640K to 1MB upper memory region and to place resident programs and drivers in that location.

Memory management evaluates the program's ability to provide and manage both expanded and extended memory and to support memory management standards such as XMS, LIM EMS, and DPMI.

DOS memory extension measures the ability of the memory manager to provide more space in the 640K conventional memory area for DOS applications running under suitable circumstances.

To rate a program's **Microsoft Windows support**, we look at the memory manager's ability to work with Windows in both 386 Enhanced mode and Standard mode and check to see whether it supports instancing (placing separate TSR program codes in each DOS partition).

Optimization rates the quality of the package's installation and optimization procedures and examines any memory-reporting program that comes with the package.



This is not as significant as it sounds since extra conventional memory is used mostly for TSRs, something which the UMB area can readily handle. But programs that force some data to stay in conventional memory, like *Lotus 1-2-3*, Release 2.*x*, will allow larger data files with this type of extra memory. Some programs run faster with extra conventional memory, and if you program, having that extra memory will let you debug larger programs.

If you really need a whopping DOS region, one of *Memory Commander*'s five modes will move the video RAM region entirely, leaving you with more than 900K for DOS. Since the price of using this is the loss of EMS and UMB space, it's useful only in special situations (such as when *Lotus 1-2-3*, Release 2.*x*, puts some data in conventional memory even when you have EMS).

There are other ways in which memory managers offer more than DOS does by itself. They can copy and remap the BIOS in slow ROM chips to fast RAM, which can speed up video and some disk operations. Memory mangers can also automate the placement of TSRs into UMBs, a process that normally requires more expertise than the average user has.

Memory managers can also recover shadow RAM on certain machines. Of course, this depends on the chip set your motherboard has and whether the particular memory manager supports that chip set. Normally, you'll need to check with the vendor.

Some older machines have only 512K of low DOS memory, and when an extended memory board is added, there's a gap between 512K and 640K, since the extended memory board's address space normally begins at 1,024K. Some memory managers will map extended memory into the 512K to 640K space, backfilling the hole for you.

HOW MUCH UPPER MEMORY SPACE?

For many users, the key to choosing a memory manager is in how much UMB space they can provide. One possible source of extra UMB space, available even under DOS if you understand its arcane syntax, is *dead system ROM*. Many machines, including many Compaqs and AMI BIOS machines, designate the first 32K of ROM for code used during boot-up and diagnostics. Once boot-up is finished, the address space used by that ROM sits unused. A memory manager can reclaim the space. *Netroom* and *386MAX* completely automate this process, while *QEMM-386* provides tools to help you determine if it's safe to do so.

In maximizing UMB space, three programs stand out. *386MAX* will let you move the video ROM BIOS and make UMB space less fragmented and therefore more useful. *Netroom* uses a swapping method akin to that used by *DESQview* or Windows in its 386 Enhanced mode to allow certain types of TSRs to be tucked away without using any UMB or conventional memory space. In addition, it has what Helix Software calls *Quantum* technology. This allows remapping of the ROM to the HMA area, freeing up 64K or even 96K of UMB space. There are, however, trade-offs.

QEMM-386's Stealth technology, introduced in Version 6.0, offers the most spectacular memory gain. This feature remaps ROM BIOS to the EMS area, and it provided an extra 83K of UMB space on our test machine.

Be warned, though; these gains sometimes go hand in hand with a certain degree of pain. While the programs have made great strides in automating installation, the advanced features may require manual tweaking of your configuration files. Moreover, if your hardware or software environment is somewhat nonstandard (and whose isn't?), enabling advanced features increases the possibility of conflicts. In several cases, we were unable to run advanced features of some of these programs on our test machine until the vendors provided specific fixes for us.

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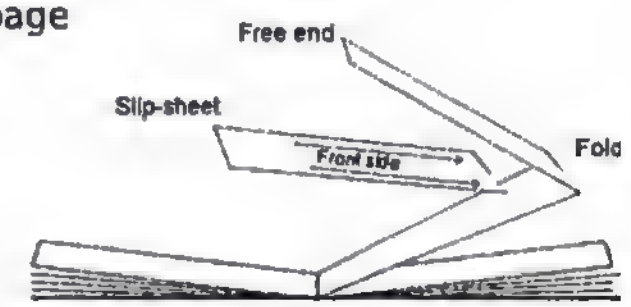

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of the products will run with Windows 3.0 in 386 Enhanced mode, allowing you to place some TSRs or drivers in the UMB area for the times when you run DOS, but there is a trade-off. If those UMB areas are free, Windows (using HIMEM.SYS) will take the memory to speed its own disk operations.

QEMM-386 is unique among these programs. It runs Windows in Standard mode while keeping the possibility of loading programs in the UMB area open. DR DOS and MS-DOS will run Windows in Standard mode, but only by enabling limited memory management. All the other programs are incompatible with Windows in Standard mode, but this could change when Windows 3.1 is introduced.

All of the products evaluated here offer compatibility with the major network operating systems. Because one of the main uses for UMB areas is to get large network drivers out of conventional memory, this feature is especially important. *Netroom* is special because its virtual machine technology allows large areas for network drivers—larger than any of the other programs.

EDITORS' CHOICE

- *QEMM-386*
- *386MAX*

All nine products evaluated in this review can do a good job of meeting your memory management requirements, depending on what those needs are. *QEMM-386*, Version 6.0, and *386MAX*, Version 6.0, however, are the best general choices.

QEMM-386 provides all of the memory management basics and helps you along with a well-designed memory-reporting utility, but what makes *QEMM* stand out is its Stealth technology. If you are among the majority of users whose hardware can run Stealth without suffering a large performance hit, you'll typically get an extra 50K to 85K of upper memory block (UMB) space for loading TSRs and drivers transparently.

386MAX stands out because of its thorough optimization program, the ease of its installation, its DOS/Protected-Mode Interface (DPMI) support, and its excellent stability and documentation. Configuring a memory manager can be a mine field of exceptions and special cases for different hardware and software. With this experience built into *QEMM-386* and *386MAX*, both products provide a certain level of assurance that you won't find a mine underfoot.

All the other products in this category deserve honorable mentions for a wide variety of reasons. *Netroom*, Version 2.13, the Editors' Choice winner when we evaluated LAN memory managers (*PC Magazine*, January 29, 1991), is most notable for the swapping technology that gives it the winning ability to load very large network drivers in the high memory area (HMA). Extended memory specification (XMS) incompatibilities experienced in our testing raise questions about future compatibility with upgraded drivers, but if your sole reason for getting a memory manager is to handle big network drivers, *Netroom* remains the product to beat.

Memory Commander, Version 2.1, is an innovative product of special interest to those who need vast amounts of conventional memory. In one of its modes it can create up to 920K of conventional RAM, a spectacular result that can satisfy the memory needs of any TSR junkie.

QMAPS, Version 2.0, is to be congratulated for its clean installation and the speed of its emulated expanded memory. The MS-DOS 5.0 Upgrade Kit is restricted and too arcane in its installation, but it does provide high loading capabilities, and therefore does much specialized memory management. *AtLast!*, Version 5.0, and the *DOS 5 Memory Management Kit* are noteworthy for extending DOS's capabilities.

DR DOS 6.0's memory management is clearly superior to that of MS-DOS 5.0. You'll have to compare the other features of the two operating systems before you commit to Digital Research's alternative operating system, but for memory management, you can't go wrong with DR DOS.

MANAGING WITHOUT A MEMORY MANAGER

While memory managers may provide some relief for your TSR RAM cram, don't lose sight of the other tools you can use in addition to or in place of a 386 memory manager.

Task switchers like *Back and Forth*, *Software Carousel*, or those built into MS-DOS 5.0 and DR DOS 6.0 can be used to access TSRs that you want to use only occasionally. On the other hand, you could use a full-fledged multitasking operating system like *DESQview*. Some TSRs allow you to place much of their code in EMS or on-disk. There are even programs to swap out some TSRs that don't have this feature. The leader here is the *Swap Utilities* series from Innovative Data Concepts.

We have focused our testing in this evaluation on 386 systems because they provide the cleanest use of memory management technology. If you have a 286 system with lots of EMS 4.0 memory or an appropriate chip set, some of the programs (or companion programs from the same vendors) allow some memory management. There is even a specialized shareware program called *Last Byte* from Key Software Products, which is tuned to specialized chip sets for maximum memory management in 286 systems (415-364-9847, available on CompuServe as TLB119.ZIP).

In order to do their memory management magic, most of these programs need to run in protected mode, which can result in performance degradation. We performed a variety of CPU speed tests, both with and without these products, and found the differences to be insignificant in most cases.

While most of these programs have their own optimization modules, RYBS's entry, *ATLast!*, works as a replacement for the managers' built-in optimization. One advantage is that it works in the background and will reoptimize every time you change your driver/TSR setup with-

out your having to rerun an optimize program.

If you have a 386 system, you can't afford not to implement some kind of memory management. For some, the memory management built into DOS 5.0 will suffice, but for others, the extra flexibility of a manager will prove very useful, no matter how complicated it is to configure.

ATLast!

by Greg Pastrick

RYBS Electronics' *ATLast!*, Version 5.0, is a unique solution to managing high memory. The software functions best as an adjunct to DOS 5.0's own high memory and extended memory services, though it can be used with any DOS version from Version 3.30 on. Interestingly, it also supports a list of other memory managers, including *Netroom, QEMM-386, 386MAX*, and RYBS's HIcard boards and HI386 software.

The $59.95 *ATLast!* package comes with a fast, fully automated installation routine specifically designed for MS-DOS 5.0 and its EMM386 driver. The *ATLast!* executable driver loads and creates its own upper memory blocks (UMBs) from the unused space in the reserved memory addresses occupied by standard devices, DOS BIOS services, and video.

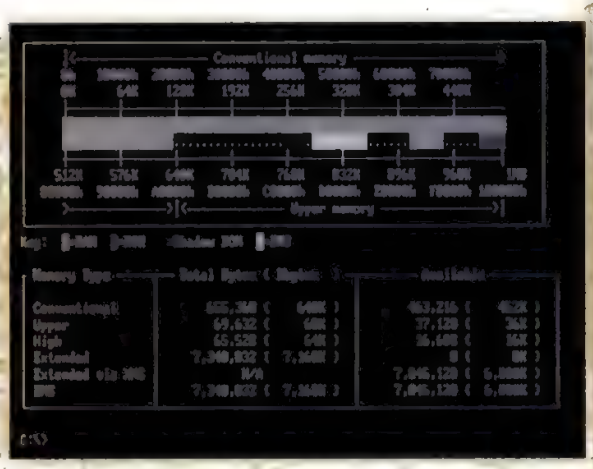
You may need some assistance from *ATLast!*'s utilities to set up and configure the software so it can manage memory. For example, HITEST is used for a pre-installation scan of memory between 640K and 1MB to locate available segments for use by the DOS 5.0 EMM386 driver. The driver is then optimized to include these segments. In effect, the installation is a three-pass process that requires little manual editing of the AUTOEXEC.BAT or CONFIG.SYS files.

***ATLast!*, Version 5.0**
RYBS Electronics Inc., 2590 Central Ave., Boulder, CO 80301; 303-444-6073.
List Price: $59.95.
Requires: 1MB RAM, DOS 5.0.
In Short: *ATLast!*, Version 5.0, is classified as a memory optimizer and is designed to work with DOS's own memory management facilities as well as third-party software and hardware. It's a totally automatic tool for loading device drivers, TSRs, and DOS tables into available UMB space.

CIRCLE 456 ON READER SERVICE CARD

SIX WAYS TO LOOK AT MEMORY

Many memory management programs include reporting utilities that give you a quick fix on how your memory is being allocated. Here's a look at the way six memory managers explain system memory.



Two of the virtues of DR DOS 6.0's automatic installation are the ease of configuring its default memory management options and the depth of its choices.

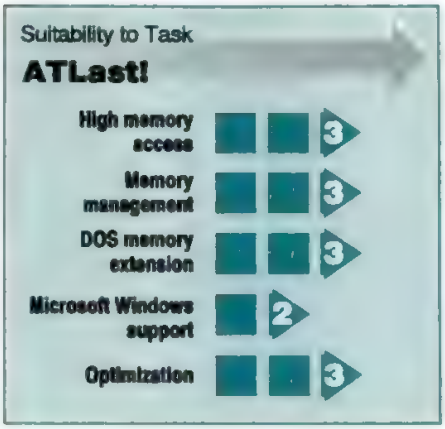
This *Memory Commander* 2.1 screen shows how the program gives a whopping 920K to DOS. The 1,024K base address is decreased only by 96K of BIOS ROM and 8K of display memory.

THREE-PASS INSTALLATION

First pass on the installation selects the memory platform. It then makes an initial assessment of memory, saves the information to a profile file, and installs the *ATLast!* driver.

The second pass is called the *learn* mode since the program analyzes the initialization and execution of all DOS commands, drivers, and programs specified in the AUTOEXEC.BAT and CONFIG.SYS files to determine how they can best be loaded into upper memory. Optimization information on the loading of programs, drivers, and commands is then saved.

The final pass reboots the system and activates the *ATLast!* driver according to the optimization specifications contained in the *ATLast!* profile file, which describes the memory requirements of all programs and drivers to be loaded.



Additional statements directing DOS to load specific devices or programs in high memory are not necessary. In fact, the program is rather smart about what it chooses to move out of conventional memory and what it decides to leave alone. For example, error-free operation on our network testing platform was ensured when the program's learn module scanned the batch file that was logging onto the network and loaded Novell's IPX in conventional memory, while taking NETx into high memory.

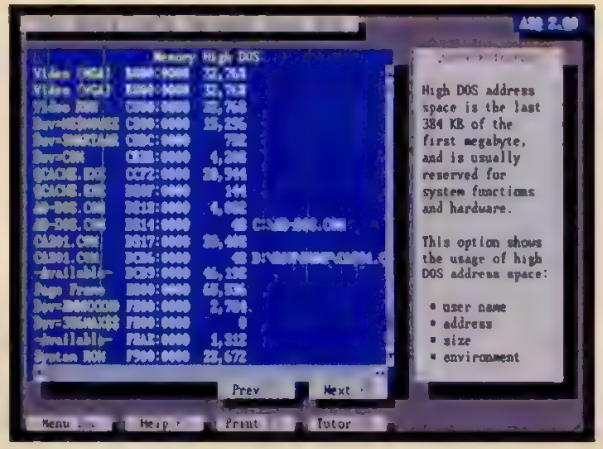
In addition, any file or program whose transportation into high memory can cause program execution trouble, such as COMMAND.COM, may be locked into low memory by simply editing the *ATLast!* profile file directly from the command line.

Similarly, *ATLast!* secures operation

Though not as complete as some other packages, *Netroom* 2.13's Discover system and memory-reporting utility are a quick and straightforward tool for exploring the status of memory allocation on your system.

The screen in *QMAPS*, Version 2.0, is a good tool for scanning memory allocation. Extending conventional memory into the unused video segments requires at least 96K of free EMS.

QEMM-386 6.0's colorful Manifest system setup and reporting utility provide a detailed memory report. Here, the report shows how *QEMM* is currently allocating available memory.



The *ASQ* program bundled with *386MAX*, Version 6.0, provides memory reporting. Notice that *386MAX*'s ROMSCAN has freed up 36K of the area usually taken by the system ROM.

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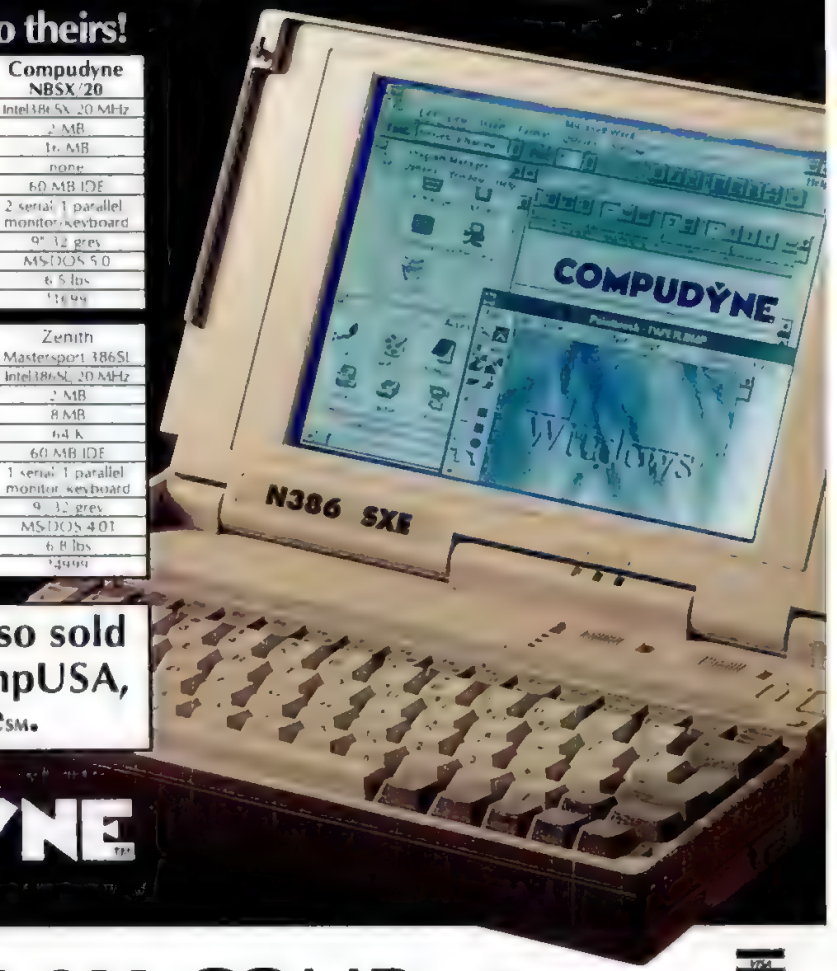
Std. Memory	2 MB	1 MB	2 MB	2 MB
Max. Memory	16 MB	5 MB	6 MB	16 MB
CPU Cache	none	none	none	none
Hard Drive	40 MB IDE	20 MB IDE	30 MB IDE	60 MB IDE
I/O Ports	2 serial, 1 parallel, monitor, keyboard	1 serial, 1 parallel, monitor	1 serial, 1 parallel, monitor, keyboard	2 serial, 1 parallel, monitor, keyboard
Screen	9" 32 grey	10" 32 grey	10" 32 grey	9" 32 grey
Software	MS-DOS 5.0	none	MS-DOS 4.01	MS-DOS 5.0
Weight	6.5 lbs	7 lbs	6 lbs	6.5 lbs
Price	$1499	$1695	$1995	$1699

	ZEOS 386SX 20	Northgate 386SX 20	**Compudyne NBSL/20**	Zenith Mastersport 386SL
CPU	Intel386SX 20 MHz	Intel386SX 20 MHz	Intel386SL 20 MHz	Intel386SL 20 MHz
Std. Memory	1 MB	1 MB	2 MB	2 MB
Max. Memory	5 MB	5 MB	6 MB	8 MB
CPU Cache	none	none	64 K	64 K
Hard Drive	20 MB IDE	40 MB IDE	60 MB IDE	60 MB IDE
I/O Ports	1 serial, 1 parallel, monitor	2 serial, 1 parallel, monitor, keyboard	2 serial, 1 parallel, monitor, keyboard	1 serial, 1 parallel, monitor, keyboard
Screen	10" 32 grey	8.5" 32 grey	10" 64 grey	9" 32 grey
Software	none	MS-DOS 5.0	MS-DOS 5.0	MS-DOS 4.01
Weight	7 lbs	6.2 lbs	6.4 lbs	6.8 lbs
Price	$1295	$1599	$2196	$3499



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PC MO-22

MEMORY MANAGEMENT SOFTWARE: SUMMARY OF FEATURES

Products listed in alphabetical order

PC—Editors' Choice ■—Yes ❑—No

	ATLast!	DOS 5 Memory Management Kit	DR DOS	Memory Commander	MS-DOS 5.0 Upgrade Kit	Netroom
List price	$59.95	$79.00	$99.00	$99.95	$99.95	$99.00
SETUP AND CONFIGURATION						
Reports on memory used by TSR during initialization	■	■	❑	■	❑	■
Reports on UMB areas not in use	■	■	■	■	■	■
Optimizes multiple regions	■	■	■	❑	❑	■
Automated setup to place LOADHIGH commands	■	❑	■	❑	■	■
Command line memory-reporting utility	■	■	■	■	■	■
Full-screen memory-reporting utility	❑	■	■	■	❑	■
Allows warm reboot	■	■	■	■	■	■
Has one-step "best fit" optimization	■	■	❑	■	❑	■
TSR/DRIVER FEATURES						
Loads TSRs high	■	■	■	■	■	■
Loads drivers high	■	■	■	■	■	■
Loads "Files=" statement high	■	❑	■	❑	❑	■
Loads "Buffers=" statement high	■	❑	■	■	■	■
Loads "LastDrive" statement high	■	❑	■	❑	❑	❑
Loads "FCBS" statement high	■	❑	■	❑	❑	■
Allows specification of region to use	■	■	❑	■	❑	■
Allows applications to use EMS frame during initialization	■	■	❑	❑	❑	■
DRIVER MEMORY USAGE						
Amount of conventional memory used	None	1.2K	1K	2K	9K	4K
Amount of UMB memory used	8K	None	28K	None	None	None
Amount of XMS memory used	None	None	None	168K	100K	64K
EXTENDED AND EXPANDED MEMORY SUPPORT						
Supplies EMS from extended memory	■	■	■	■	■	■
Can move EMS frame location	■	■	■	■	■	■
Includes himem-compatible HMA server	■	■	■	■	■	■
Includes XMS 2.x server	■	■	■	■	■	■

of Microsoft Windows 3.0 in 386 Enhanced mode through its Preconfigured command, which locks the FILES= statement in CONFIG.SYS into conventional memory. Unless otherwise directed, *ATLast!* will load standard DOS statements such as BUFFERS=, FILES=, and DEVICE= into available upper memory blocks. It even loads portions of itself into high memory, where free mappable expanded memory pages can be converted to UMBs.

No matter what your system configuration and expanded or extended memory requirements are, you'll be able to squeeze more conventional memory out of your PC with other memory managers than you will with *ATLast!* Nevertheless, few of the other memory management utilities reviewed here provide as fast a setup or as straightforward an operation as *ATLast!* does.

DOS 5 Memory Management Kit

by Greg Pastrick

Priced at $79, Biologic's *DOS 5 Memory Management Kit*, Version 2.0, is a collection of programs designed to work with DOS's high memory area (HMA) and expanded memory drivers. As such, *Memory Management Kit* not only enhances the performance of MS-DOS 5.0 but works with a full range of processors on the market to create usable conventional and upper memory for terminate-and-stay-resident programs (TSRs) and device drivers.

HRAM 1.1 is the heart of the utility package; it includes a set of devices and a program that uses the EMS 4.0 spec to create high DOS memory and boost conventional memory. It accomplishes this by filling unused high memory with expanded memory and then loading TSRs and device drivers into the newly created memory space.

Memory Management Kit also includes a TSR swapping program called *min-mem* 2.0 and its own caching software, *VRAM* 4.21, which converts extended memory to expanded memory on 286-based systems, or creates up to 32MB of simulated expanded memory from disk space. For the purposes of this review, we focused on the capabilities of *HRAM* 1.1.

DON'T IGNORE THE DOCUMENTATION

Properly installing and running *Memory Management Kit* requires a bit more work than the printed documentation would have you believe. This is one program where you cannot ignore the documentation file on-disk. Print it, use it, learn it.

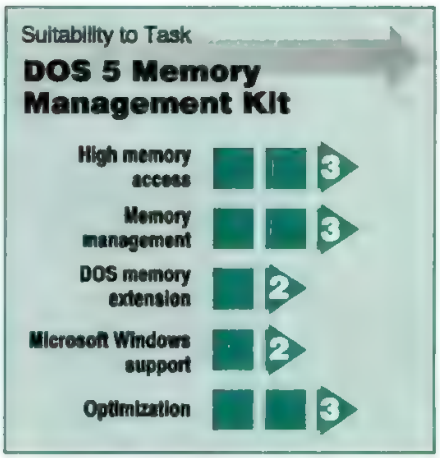
	QEMM-386	QMAPS	386MAX
	$99.95	$129.95	$99.95
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	■	■	■
	3K	2K	1K
	None (12K with Stealth)	None	3K
	160K	80K	225K
	■	■	■
	■	■	■
	■	■	■
	■	■	■

CONTINUES

It's the only way you can really get the installation sequence right and optimize your system effectively.

There's very little automation outside of copying the *Memory Management Kit* files to a subdirectory. But to Biologic's credit, the drivers and programs that are a part of *HRAM* provide thorough and detailed optimization recommendations based on the programs and drivers resident on your system.

Since *HRAM* is meant to optimize high DOS memory and available EMS, it works with all the usual DOS commands and drivers that are already a part of your DOS package. To begin, *HRAM* requires HIMEM and EMM driver lines to be included in your CONFIG.SYS file, as well as a line containing "DOS=UMB". Once this is accomplished, the system is rebooted, and the *Memory Management Kit* runs its CHKMEM program to get an



overview of all the memory available. When used with the /C parameter, CHKMEM gives a listing of recommended EMS parameters to be added to the CONFIG.SYS file before rebooting and proceeding with the installation.

For optimizing memory, the *HRAM* device drivers must then be entered on separate lines in the CONFIG.SYS file. You need to add the /S parameter temporarily to the DEVICE= HRAMDEV.SYS line to calculate the resident and initialization memory size of programs and drivers. *HRAM* also blocks programs from loading into high DOS memory.

When rebooting, the *HRAM* program is used from the command line with /C to analyze all existing programs and drivers and to list recommended commands and parameters for inclusion in the AUTOEXEC.BAT and CONFIG.SYS files. *HRAM*'s /L parameter also provides an essential memory analysis, a list of the best-guess loading order, and memory regions for programs and drivers. Take care to enter the commands and parameters as instructed, remove the /S switch, and reboot before proceeding.

The information generated by these listings is invaluable for fine-tuning your system; they are the smartest aspects of the program. They're not infallible, though. Its recommendation to load NETx before IPX shows the limits of its intelligence, but it fairly and efficiently assesses which programs and devices can and cannot be loaded into the available upper memory and specifies the memory regions where they best fit. An additional feature of *HRAM* is its ability to determine whether or not to convert 64K of EMS temporarily to high DOS memory during program initialization.

The program itself is optimized for operation on 386-based systems. With the *HRAM* device driver, you can add parameters to enable the expanded memory page-frame buffer, and exclude or include specific address ranges to be converted to high memory.

600K COMBINED MEMORY

All things being equal, the multiple reboots and heavy manual editing of the AUTOEXEC.BAT and CONFIG.SYS files are a small price to pay for good memory management. In fact, the program did quite well, leaving nearly 600K of combined conventional and upper memory free on our fully loaded network testing platform. What's more, on our naked, standalone system, the program's default installation produced 200K of free upper memory, for a combined 808K of conventional and upper memory.

When purchased alone, *HRAM* 1.1 sells for $59, and the entire *Memory Management Kit* is being offered temporarily for $79. Biologic is due to release a more fully automated version of its memory management utility in the first quarter of 1992. You'll probably want to wait for the version that gives the easiest and most automated installation, as long as the fine analysis, recommendation, and reporting functions currently offered by *DOS 5 Memory Management Kit* are not lost.

***DOS 5 Memory Management Kit*, Version 2.0**
Biologic, 7950 Blue Gray Circle, Manassas, VA 22110; 703-368-2949.
List Price: $79, including *HRAM* 1.1 memory management, *VRAM* 4.21, and *Min-mem* 2.1 utilities.
Requires: 1MB RAM, DOS 3.0 or later.
In Short: The strength of *DOS 5 Memory Management Kit*, Version 2.0, is in its memory analysis, optimization, and reporting features. All of the features are backed by good conventional memory expansion. Installation and fine-tuning require heavy editing and careful execution of the scripted optimization routines. Be sure to get the newer, automated version that is due out in January 1992.

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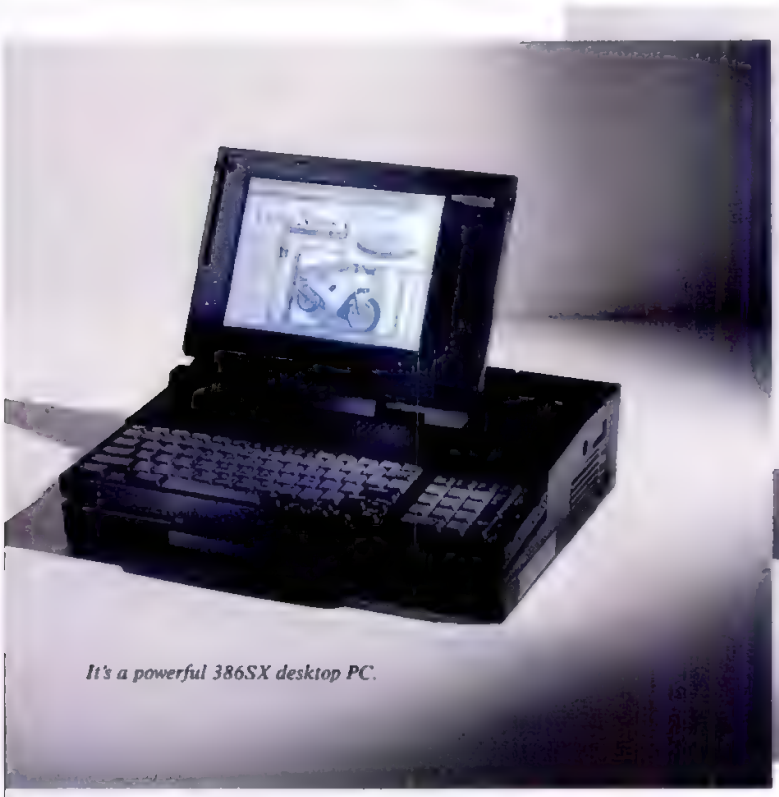

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CIRCLE 156 ON READER SERVICE CARD

MEMORY MANAGEMENT SOFTWARE: SUMMARY OF FEATURES

Products listed in alphabetical order

PC—Editors' Choice ■—Yes ❑—No

	ATLast!	DOS 5 Memory Management Kit	DR DOS	Memory Commander	MS-DOS 5.0 Upgrade Kit	Netroom
EXTENDED AND EXPANDED MEMORY SUPPORT (continued)						
Allows free switching between EMS and extended memory	❑	❑	■	❑	❑	■
Acts as VCPI server	■	■	■	■	■	■
Acts as DPMI server	❑	❑	❑	❑	■	❑
Allows alternate register sets (ARMS)	❑	■	❑	❑	■	■
CONVENTIONAL MEMORY						
Moves extended BIOS on PS/2s and other systems	❑	❑	■	■	❑	■
Can extend conventional memory to 704K on monochrome systems	■	■	❑	■	❑	■
Can extend conventional memory to 736K on CGA systems	■	■	❑	■	❑	■
Moves ROMs to fast RAM	❑	❑	■	■	❑	■
MICROSOFT WINDOWS OPTIMIZATION						
Compatible with Microsoft Windows 3.0 in Standard mode	❑	❑	❑	❑	■	❑
Compatible with Microsoft Windows in 386 Enhanced mode	■	■	■	■	■	■
Supplies EMS to DOS partitions in Microsoft Windows 3.0 Standard mode	❑	■	❑	❑	■	❑
Loads TSRs before Microsoft Windows	■	■	❑	■	❑	❑
Keeps multiple copies of UMB for DOS partitions in Microsoft Windows	❑	■	❑	❑	❑	❑
COMPATIBILITY						
Compatible with *DESQview*	■	■	■	■	■	■
Compatible with NetBIOS	■	■	■	■	■	■
Relocates *NetWare* shell (net3, net4, net5)	■	■	■	■	■	■
Compatible with *VINES*	■	■	■	■	■	■
Recovers 384K RAM mapped to high memory on some Compaqs	❑	❑	■	❑	❑	■
Supports SCSI bus masters	■	■	■	■	■	■
Recovers shadow RAM on machines with Chips and Technologies chip set	■	■	■	❑	❑	■
SUPPORT/DOCUMENTATION						
On-line context-sensitive help	■	❑	■	■	■	■
Bulletin board support	■	■	■	■	■	■

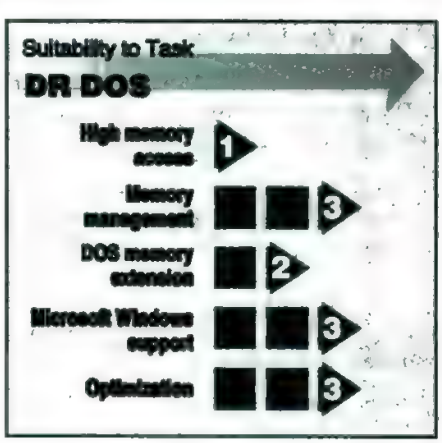
DR DOS 6.0

by Greg Pastrick

Digital Research's DR DOS, Version 6.0, brings versatility and functionality to high memory management not found in Microsoft Corp.'s rival operating system. Though earlier releases were plagued with installation and compatibility bugs, Version 6.0 runs smoothly. The memory management facilities included in its MemoryMAX feature offer options that were once available only in standalone memory managers and are still not available in MS-DOS.

Picking up where DR DOS 5.0 left off, Version 6.0 supplies drivers that support the LIM EMS 4.0 spec, relocate the DOS kernel into upper memory, remap the BIOS code in ROMs to fast RAM, and load specified terminate-and-stay-resident programs (TSRs) and devices into high memory. In addition, the MEMMAX command may be used with a selection of switch parameters to enable and disable access to upper, lower, and reserved video memory. The ability to turn these features on and off directly from AUTOEXEC.BAT is invaluable for optimizing system memory while protecting memory-sensitive applications. It is also a benefit for gaining as much of the reserved video segments as possible without causing application crashes.

The components of DR DOS 6.0's MemoryMAX program are its own EMM386 driver, the HIDOS driver (which relocates the DOS kernel into upper memory), and an additional driver compatible with IBM's XMA standard for converting extended to expanded memory on PS/2s.



Although the setup of the MemoryMAX collection is part of the operating system installation, offering some general best-fit optimization on the first pass, most of the fine-tuning for system configuration requires heavy editing of the AUTOEXEC.BAT and CONFIG.SYS

	QEMM-386	QMAPS	386MAX
	■	■	■
	■	■	■
	❑	❑	■
	■	■	■
	■	❑	■
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	■	■	■
	■	■	■

files. But taking the time to optimize does pay off. Up to 721K of conventional memory was accessed during installation on our test system without any programs or TSRs loaded. On the fully loaded network system we used for testing, a somewhat less impressive 525K was left, but without IPX and NETx running, 610K of lower memory remained free.

MEMORY REPORTING BETTER THAN DOS

In most cases, the auto-scan switches may be applied to the driver controls for frame, amount of LIM EMS memory, copying of BIOS code from ROM into RAM, and location of the DOS kernel. However, use of the operating system's fine, detailed memory-reporting features can locate and define specific segments and upper memory addresses to squeeze more memory space out of your system.

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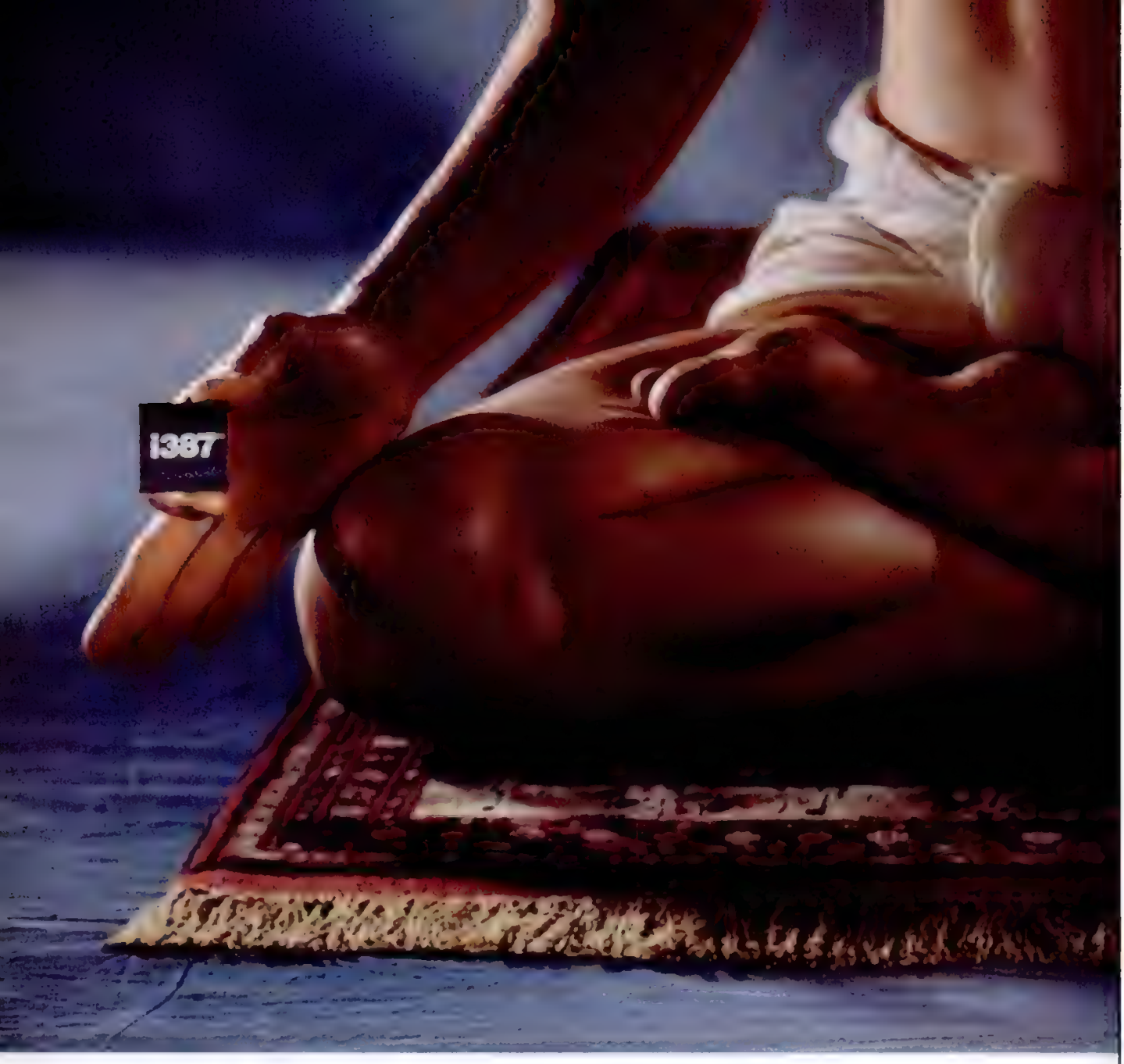

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FACT FILE

DR DOS, Version 6.0
Digital Research Inc., Box DRI, 70 Garden Ct., Monterey, CA 93942; 800-274-4374, 408-649-3896.
List Price: $99.
Requires: 1MB RAM.
In Short: DR DOS, Version 6.0, provides more memory management features than MS-DOS 5.0 offers. You get efficient and impressive conventional memory expansion without the overhead or extra cost of an additional memory manager.

CIRCLE 458 ON READER SERVICE CARD

There are additional switches to release unused video address space for conventional memory (64K to 96K), as well as to make an additional 256K of extended memory available on Compaq 386 and 486 systems. These enhancements require adding the /V and /C switches to the EMM386 driver line, respectively. They do, in fact, maximize memory, but when using graphical interfaces, you'll need to turn the video switch off.

DR DOS's MemoryMAX automatically moves the EMM386 and HIDOS drivers into high or upper memory, but you do have the option of forcing the location of most if not all of the memory dedicated to these drivers into lower memory. This will lend more space for loading buffers and TSRs, and for installing DOS commands high in memory.

As in MS-DOS, the DR DOS memory driver does not automatically reserve memory regions for video and system ROM BIOS shadowing. You'll need to experiment with settings to optimize upper memory. Likewise, making the most of available UMBs by optimizing the order and loading of devices, programs, and TSRs is a matter of trial and error. DR DOS cannot be loaded high by another memory manager without its own HIDOS.SYS driver.

Fortunately, DR DOS comes with strong technical support, and the documentation serves as a more-than-adequate primer on using the operating system's MemoryMAX features. Still, it doesn't show you little extras like using the /MH switch with the environment line in your CONFIG.SYS, or teach you how to fiddle with settings to find every last kilobyte of RAM you can.

As it stands, DR DOS 6.0 is a viable alternative to MS-DOS, and its memory management features and functions make it an equally attractive alternative to standalone memory managers as well.

Memory Commander
by Barry Simon

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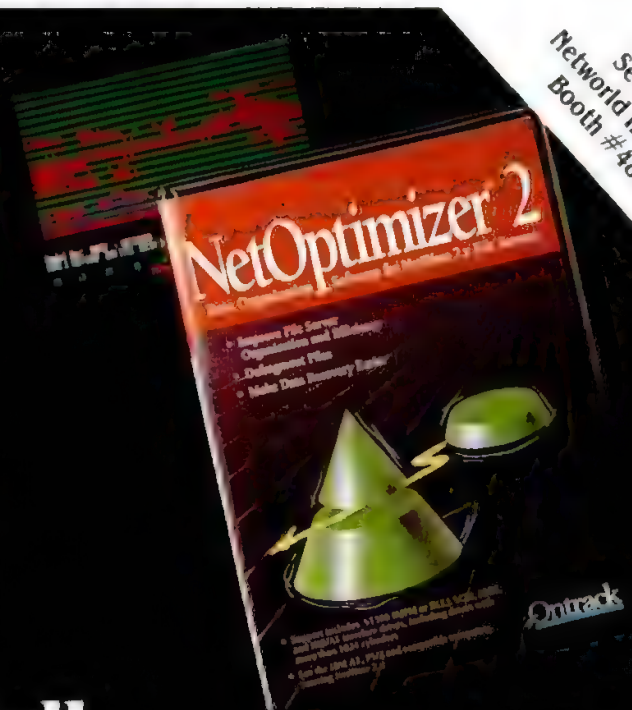

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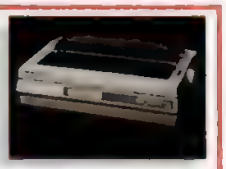

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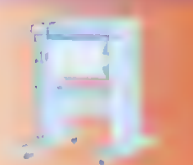

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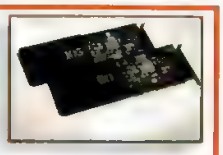

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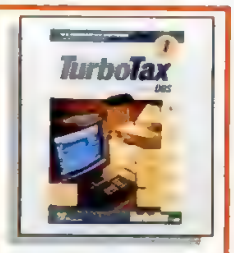

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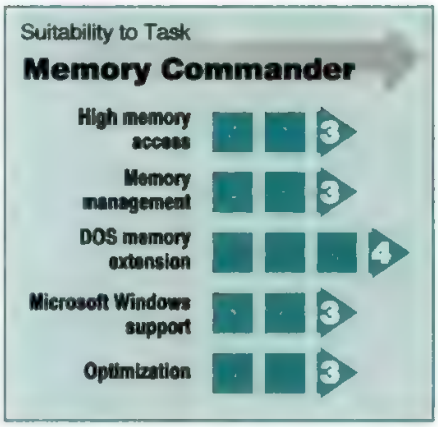


space. Because video RAM isn't fragmenting memory into DOS and upper memory block (UMB) regions in this scenario, you have to have a slightly different mindset when using this program.

Memory Commander can run in five different modes, and it dynamically switches among them depending on the program you are running. Mode A is the usual 640K DOS setup, with video RAM starting at the address just above 640K and with UMB regions beyond that.

Mode B resembles several other memory managers in which the first bit of upper memory is made available to DOS when you aren't running graphics, giving DOS 704K on monochrome systems and 736K on color systems in text mode.

MIND-BOGGLING MEMORY

Modes C through E, however, set *Memory Commander* apart because they actually move the video RAM addresses as well as the video ROM BIOS. Typically, the top 64K used by system BIOS and the transferred video BIOS takes 32K below that. And just below that is the video RAM addressing: 128K in mode C (which has full graphics support), 32K in mode D, and 8K in mode E. Mode D mimics the full text-mode region, while mode E works for most text-mode programs.

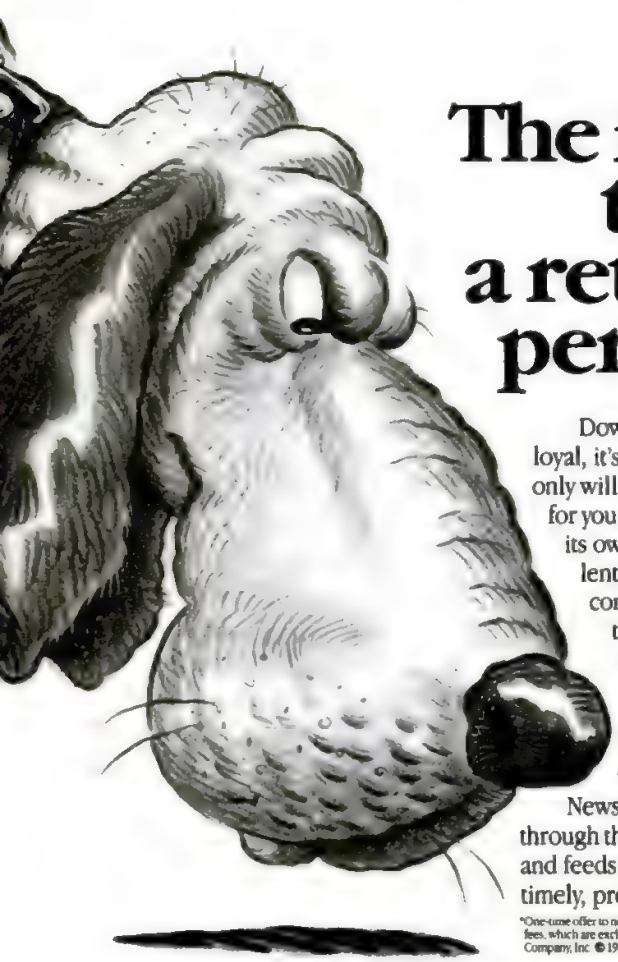
How much memory do you get? Mode C has as much as 800K, mode D has 896K, and mode E has a full 920K. It's nothing short of mind-boggling to run CHKDSK or MEM and see a report of 942,080 bytes of total conventional memory available.

Memory Commander needs to do some fancy footwork in order to deal with moved RAM. For programs that write to the screen using BIOS calls, the job is easy. *Memory Commander* just needs its own version of the BIOS. Another class of programs that *Memory Commander* favors are those that use the *Topview* API (which is still in use because *DESQview* adopted it), a protocol that forces programs to query the system for screen locations.

VIDEO PROBLEMS AND SOLUTIONS

Things get tricky when programs that write directly to screen assume they can use all of the usual memory locations. *Memory Commander* uses the protection features of the 386 chip to cause a fault whenever any program tries to read or write from the usual video RAM regions. The control is then passed to *Memory Commander*, which tries to figure out if the program was accessing actual video RAM or if it was getting or placing data in what was once video RAM but is now memory accessible by programs.

Even with these strategies, there are some programs that can't be run in modes C through E. Many screen capture programs we tried wouldn't run in mode E, and *WordPerfect*'s preview won't run in



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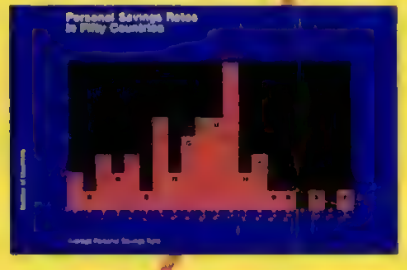

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PERFORMANCE TESTS: MEMORY MANAGEMENT SOFTWARE

All of the memory managers we tested can make more memory available to DOS applications without significantly affecting performance, but you usually need to tweak your CONFIG.SYS file to get there.

WHAT THE NUMBERS MEAN

Memory Commander provided the biggest block of conventional memory: 647K with all of PC Magazine Labs' TSR programs loaded. In maximum memory mode, however, there was a degradation of video performance; you can see a similar effect when *QEMM-386*'s Stealth feature is activated.

We tested *QEMM-386* both with and without its Stealth feature, which moves the video BIOS. The EGA/VGA test shows that using the Stealth feature significantly slows down video performance, but the positive side of that trade-off is a big increase in contiguous high memory space.

Hard disk performance was also somewhat affected by all of the standalone memory managers except for *Netroom* and *386MAX*, which had as little impact on disk performance as MS-DOS and DR DOS. *386MAX* turned in good results across the board, as one would expect from one of the technology leaders. The surprise performer of the group was *QMAPS*, which also placed among the leaders on most tests.

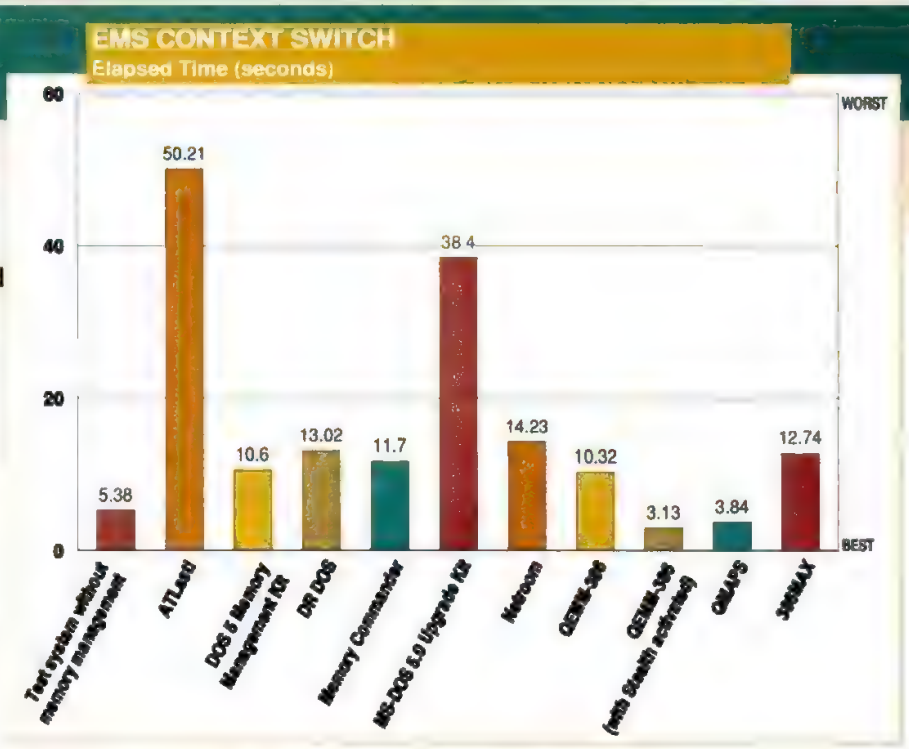
HOW WE TESTED

We tried to answer two questions with our tests: How much memory do these programs make available to DOS applications, and does access to more memory result in a loss of disk speed?

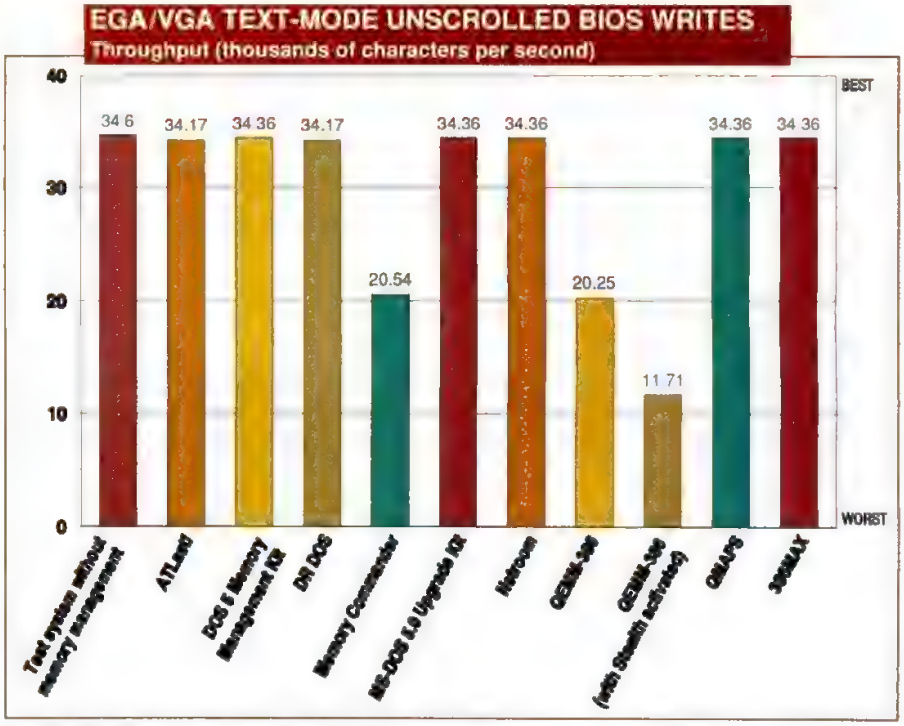
To answer those questions, we loaded our test system with enough TSR programs to tax even the best methods of memory management. The TSR programs included the shareware program *CED* (which uses 16.5K); two *PC Magazine* utilities, Schedule (15.4K) and PCSpool (22.8K); *Super PC-Kwik*, a disk cache (65.6K); and *Keyworks*, a keyboard macro utility (109K). We then loaded the *NetWare* network drivers IPX (27.2K) and NET5 (41.9K).

After installing the memory management programs, we used the optimization features they provide to access as much DOS memory as possible. Then we ran three of PC Magazine Labs' performance tests to gauge changes in system, video, and hard disk performance.

We ran the tests on a Compaq Deskpro 386/25 with 9MB of RAM and a 300MB hard disk. It was connected to a Novell network using a Proteon token-ring board.



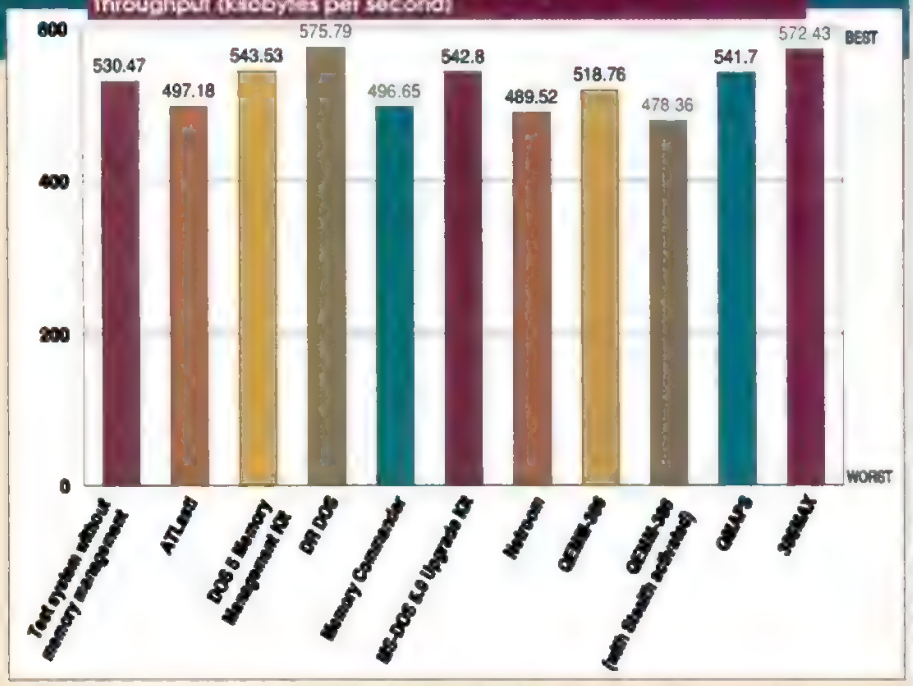
The **EMS Context Switch** test simulates alternate hardware registers in software and measures the time it takes an expanded memory manager to swap between the two contexts 50,000 times. Smaller numbers represent better performance.



The **EGA/VGA Text-Mode Unscrolled BIOS Writes** test measures the amount of data written to the screen in 10 seconds using interrupt 10h BIOS calls. It is measured in thousands of characters per second, and larger numbers represent better performance.

DOS FILE ACCESS (LARGE RECORDS)

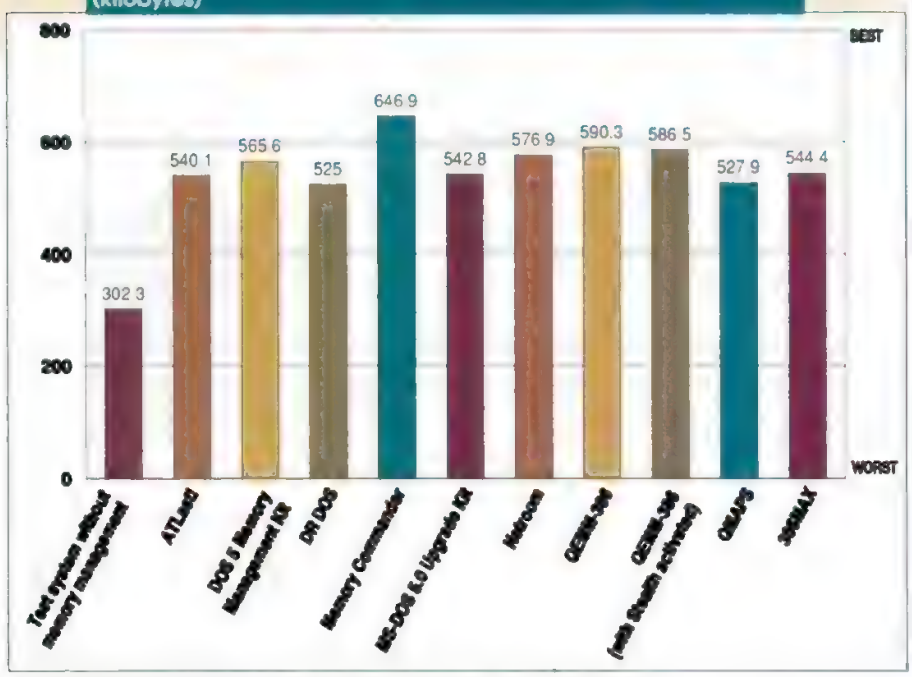
Throughput (kilobytes per second)



The **DOS File Access (Large Records)** test measures disk throughput during 10 seconds of file creation, writing, and reading. This test exercises the hard disk, the disk controller, and the bus. Larger numbers represent better performance.

AVAILABLE DOS MEMORY

(kilobytes)



The measurement of **Available DOS Memory** is reported to the DOS 5.0 MEM/C command after we load all of the TSR programs and drivers on our test system. It represents the size of the largest application program that can be run. For comparison, the result for the test system without memory management is reported with no LOADHIGH drivers activated. Larger amounts of available memory indicate better memory management.

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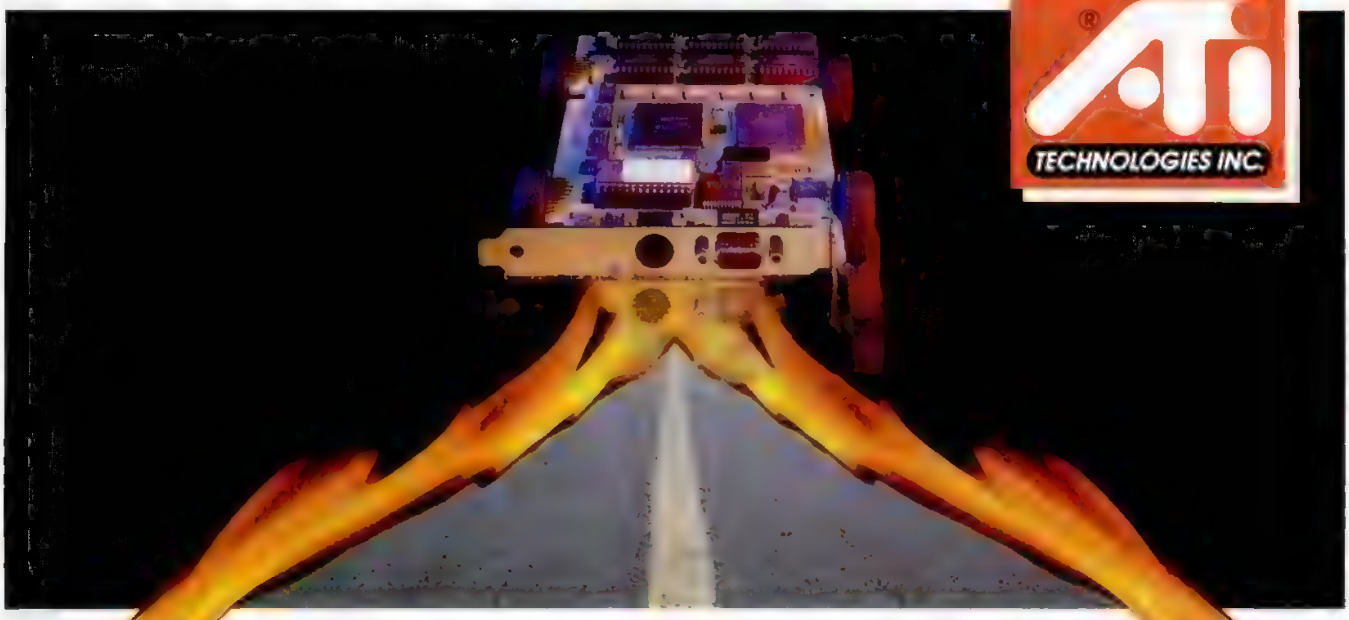

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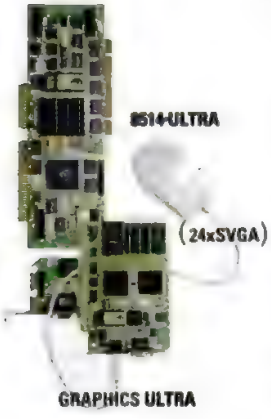

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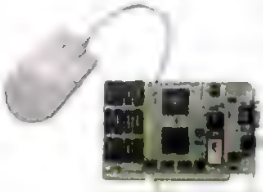

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CIRCLE 337 ON READER SERVICE CARD

Memory Commander, Version 2.1
V Communications Inc., 4320 Stevens Creek Blvd., #275, San Jose, CA 95129; 408-296-4224
List Price: $99.95.
Requires: 512K extended RAM, DOS 3.0 or later
In Short: Wow! Up to 920K RAM is available for DOS. *Memory Commander*, Version 2.1, is the product of choice if you need a huge conventional memory area, but it is a little weak if you are mainly in search of UMB space.

CIRCLE 459 ON READER SERVICE CARD

and *WordPerfect*'s preview won't run in mode C. *Memory Commander* maintains its own database telling it what modes to use for each program. It ships with the information for nearly 100 popular programs, and you can even add your own. For programs not yet installed, it defaults to mode A.

If all programs could run in modes C through E, there would be no need to load anything high. In those modes, programs have a large unbroken memory area to use and drivers can be loaded low without crowding applications. But there are programs that you'll need to run in modes A or B, and for them to have adequate memory, you'll want to use UMBs. Here, *Memory Commander* falls somewhat short. It has basic UMB support, but it lacks extras like an optimization utility or the equivalent of *386MAX*'s FlexFrame.

Memory Commander has some unique touches. It ships with a RAM disk and an ANSI driver, both of which use no memory below 1MB. It extends its program database to include which TSRs and drivers are to be loaded high, a cleaner approach than arcane lines in your CONFIG.SYS and AUTOEXEC.BAT files.

A major upgrade is planned for early 1992 that should include support for shared expanded memory/extended memory and the capability to free BIOS addresses, just as *QEMM*'s Stealth does. Not surprisingly, V Communications' 286 support is a bit unusual: Instead of requiring the right chip set, its $149.95 *MegaMizer* includes an add-in card.

Memory Commander is an innovative product that will be your best choice if you must have a really large memory pool for DOS (debugging a large program with conventional memory debuggers, for example). But no matter how you work, *Memory Commander* is an interesting and unique memory manager to consider.

MS-DOS 5.0 Upgrade Kit

by Barry Simon

MS-DOS 5.0 Upgrade Kit is the first version of DOS to include any real memory management, and most users can immediately benefit from it, no matter what kind of computing they do. But the operating system in general lacks the flexibility and ease of use associated with specialized memory management programs.

DOS 5.0 includes two essential memory management features: the ability to load terminate-and-stay-resident programs (TSRs) and drivers into high memory and the ability to emulate expanded memory (EMS). Unfortunately, DOS also lacks two major features that are included in most of today's memory managers. It will not remap the BIOS code in slow ROMs into fast RAM, and you cannot use the video memory areas to increase the amount of available memory.

With DOS you do have the option of programming certain areas of upper memory block (UMB) space as usable, thus recovering dead space, but DOS still doesn't offer any in-depth analysis features to help you find these vacant memory addresses.

You can manually move TSRs and drivers into high memory with the loadhigh and devicehigh commands, but there is no optimization program to help you put the code in the best open space. If the UMB area is fragmented, DOS will simply try using the largest area available. Other memory managers are more sophisticated in finding optimal fits.

Memory management is split between HIMEM.SYS, which handles the high memory area and extended memory, and EMS386.SYS, which manages UMBs and EMS. Though one reason for that separation may be that HIMEM.SYS can be used on 286, 386, and 486 machines, while EMM386.SYS works only on 386 and 486 systems, the decision to split the management seems to have been a case of putting the DOS developers' programming task above ease of use for the user.

> MS-DOS 5.0 is the first version of DOS to include any real memory management, and users can immediately benefit from it, no matter what kind of computing they do.

LOADING DOS HIGH AND CHANGING CONFIG.SYS

When you install the MS-DOS 5.0 Upgrade Kit on a 386 (or higher) where an earlier version of DOS has been installed, the SETUP program will add two commands to the CONFIG.SYS file: DEVICE=C:\DOS\HIMEM.SYS and DOS=HIGH. These commands load the DOS kernel into high memory. However, EMS386.SYS is not loaded automatically, nor is UMB support automatically turned on.

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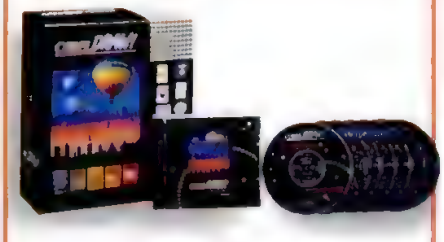

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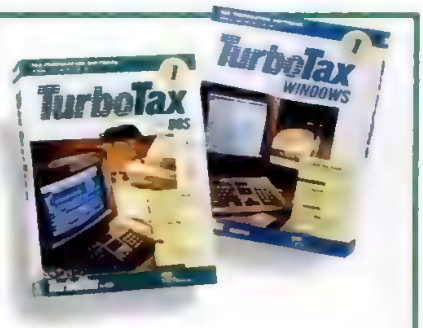

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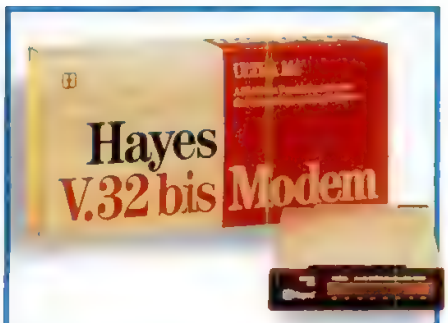

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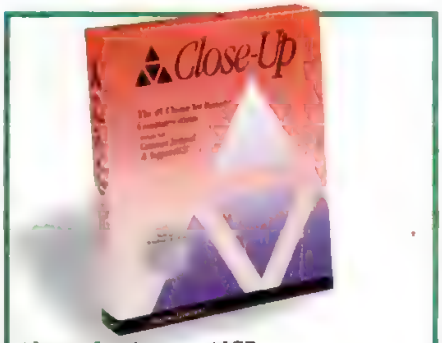

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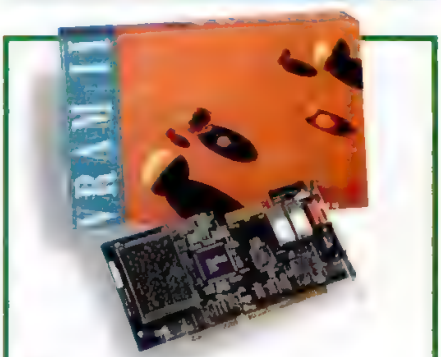

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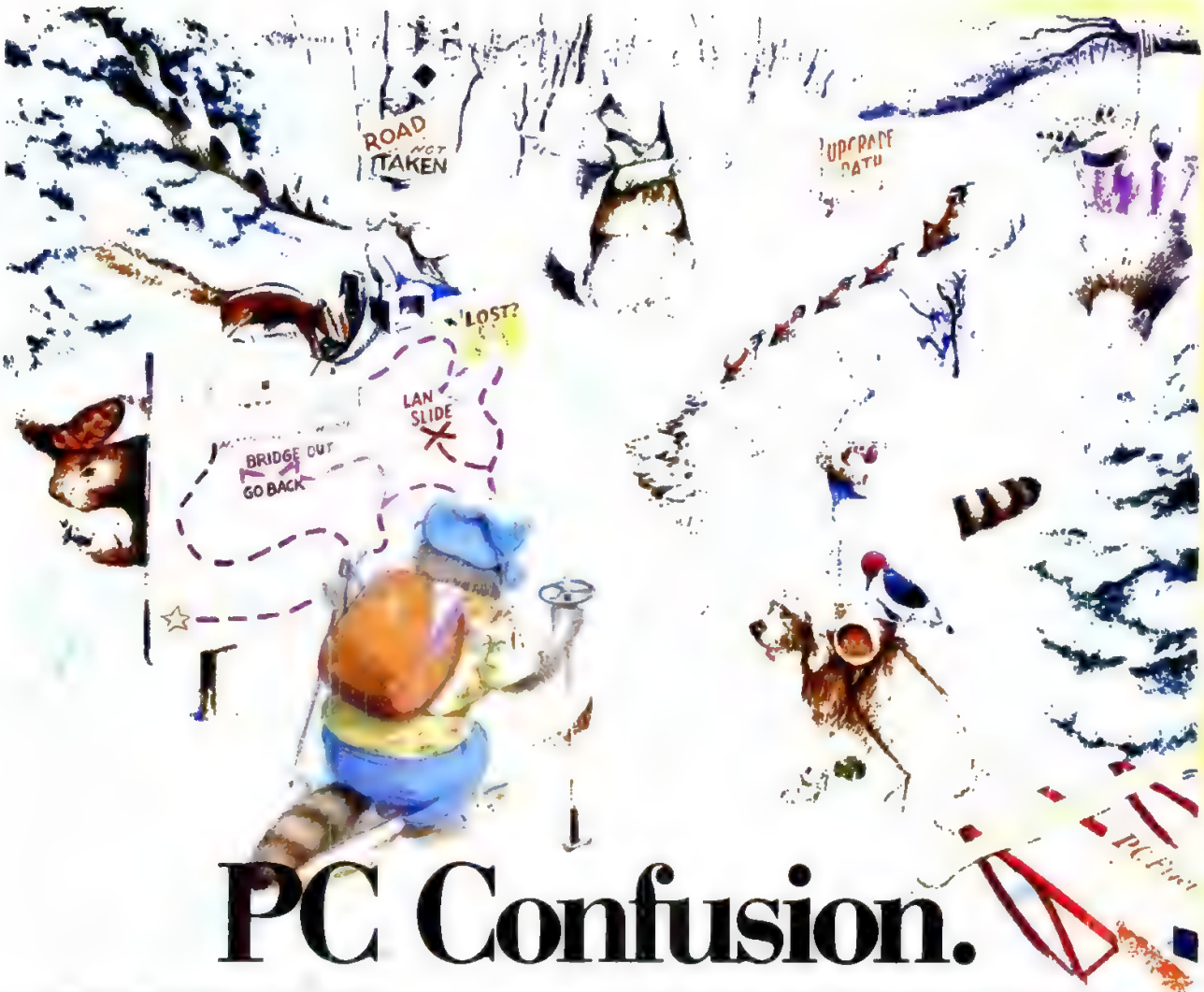

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To add to the confusion, when you do load EMS386.SYS, you turn on EMS support but not UMB support. You need to include a separate directive (DOS=UMB) to turn on UMB support. You also need to include one of the keywords "NOEMS" or "RAM" on the EMS386.SYS load line (the example in the manual for using DEVICEHIGH doesn't show either).

To use DOS 5.0 as a memory manager, be sure to

- load HIMEM.SYS before EMS386.SYS;
- include a line reading DOS=HIGH, UMB in your CONFIG.SYS;
- use the RAM switch with EMS386.SYS if you want EMS memory, or use the NOEMS switch if you don't;
- try the switch i=e000-f7ff on EMS386.SYS to use address space that DOS doesn't try to recover;
- look into specifying the location of the page frame with the *m* command parameter in order to avoid fragmenting the UMB region.

It doesn't matter where you place the DOS= command; DOS scans the CONFIG.SYS file first for just such a line, since the DOS kernel supports the Virtual Control Program Interface (VCPI) and protected-mode programs, including *Lotus 1-2-3*, Release 3.0, and *AutoCAD*. Unlike leading memory managers, DOS does not have a shared pool of EMS and extended memory.

MS-DOS 5.0 Upgrade Kit
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 206-882-8080
List Price: $99.95
Requires: 512K RAM.
In Short: MS-DOS 5.0 Upgrade Kit's memory management tricks are conservative, limited, and almost entirely manually activated. Even so, any PC user can benefit from the extra conventional memory that it frees up.

CIRCLE 460 ON READER SERVICE CARD

> Unless you really feel that you have a need for more sophisticated memory management, sticking with DOS 5.0 by itself can take care of many of your basic memory management problems.

APPROPRIATELY CONSERVATIVE APPROACH

DOS takes a very conservative approach to memory management, and that's appropriate if you consider that it's a mass-market product. Should you be satisfied with the memory management services DOS provides for free, or should you get a specialized memory manager like *QEMM-386* or *386MAX*? Unless you really feel that you have a need for more sophisticated memory management, sticking with DOS by itself can take care of many of your basic memory management problems.

What are good reasons to add a memory manager to DOS?

- You have the need for shared EMS/extended memory services.
- You want an easier way to maximize memory instead of DOS's trial-and-error method.
- You have more TSRs and drivers than will fit into DOS's UMBs.

In those situations, adding a memory manager to DOS's own tools will be to your advantage.

Netroom

by Barry Simon

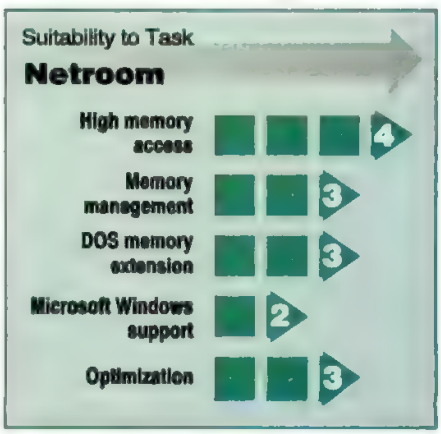
Helix Software's $99 *Netroom*, Version 2.13, is a general-purpose 386 memory manager with a misleading name. While its virtual machine capability (Netswap) is of special interest to those loading large network drivers, it's not a network-specific program. Rather, it's a collection of high-end features connected to two unique technologies, Quantum and Netswap, which make it an especially interesting entry among the memory managers we evaluated.

Netroom has all the features you could hope for in a good memory manager. It sets up expanded (EMS) and extended memory with Virtual Control Program Interface (VCPI) support, and by temporarily using the EMS page frame to load programs that shrink after booting, *Netroom* is able to load terminate-and-stay-resident programs (TSRs) and drivers high. You can also use it to move much of DOS's file table to upper memory blocks (UMBs) and remap BIOS code from ROMs into fast RAM.

LEAVING COMPETITORS BEHIND

Aside from the features you'd expect from a memory manager, *Netroom* leaves much of the competition behind when it comes to its Helix-developed Quantum technology. Quantum moves most or all of the system and video BIOS into HMA. On a typical system with 32K of VGA ROM BIOS and 64K of system ROM BIOS, *Netroom* can fit it all into the 64K HMA. By using a series of compression techniques and eliminating unused system ROM after bootup, Quantum technology can mean a gain of up to 96K of UMB space for your drivers and TSRs.

Unfortunately, you won't actually gain



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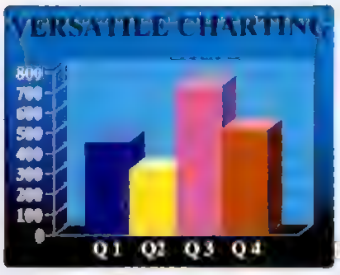

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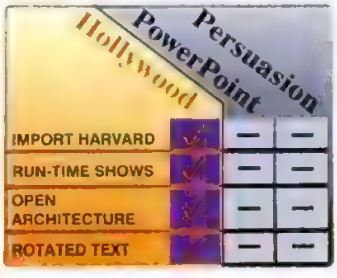

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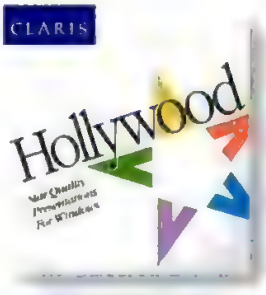

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that full 64K if you have another program that can't use the HMA region; such programs include Microsoft Windows, *DESQview*, and DOS 5.0 itself. DOS loads much of its kernel into HMA. The kernel itself is only 37K, and *Netroom*'s Quantum technology will load that into UMB. So the BIOS code that was using 64K of UMB space is switched for a kernel taking 37K, which results in an ultimate gain of 27K.

It may not even be that much. DOS 5.0 loads buffers into HMA, and if you have BUFFERS=4 (a good idea only if you have a cache), that's only 2K more. But with BUFFERS=40, DOS is already using most of the UMB region. In addition, the new 8.10 mouse driver also loads itself into the UMB region.

Depending on your system, the gain from Quantum may be as much as 27K, but it is likely to be less. That gain is less than what you'll get from *QEMM*'s Stealth, but our tests show that *Netroom* doesn't suffer from the same performance penalties that Stealth does. To show you just how your memory is allocated, *Netroom* includes *Discover*, a reporting utility like *QEMM*'s *Manifest* and *386MAX*'s *ASQ*.

TASK-SWAPPING TECHNOLOGY

In addition to Quantum technology, there is a separate feature called Netswap. To use Netswap, you create a virtual machine for TSRs and drivers. Helix has a program to allow loading of device drivers in a batch file. This file is then loaded into a separate virtual machine and is swapped in as needed. On a 386, the swap region is conventional memory, so under ideal circumstances, this virtual machine can be as large as 576K. The product's manual warns that some hotkey-based programs may have trouble loading in the swapping mode, but the method is ideal for large network drivers.

The package comes with numerous components. If you can get away with using the automatic installation and optimization program, this multiple-driver approach presents no problem, but if you need to do any hand-tuning, you're faced with a jumble of pieces, each with its own arcane syntax. In particular, if you want to use Netswap, be prepared to cope with manual installation.

Surprisingly, the version of *Netroom*

***Netroom*, Version 2.13**
Helix Software, 47-09 30th St., Long Island City, NY 11101; 800-451-0551, 718-392-3100.
List Price: $99; four users, $179; ten users, $299; 50 users, $595.
Requires: 64K extended memory on 286 machines, 640K extended memory on 386 machines, DOS 3.2 or later.
In Short: *Netroom*, Version 2.13, stands out for its Quantum and Netswap technologies, which make this memory manager the one to choose if you have network drivers larger than 200K.

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System Requirements:
IBM or compatible PC, DOS 2.0 or above, 512K RAM and a hard disk.

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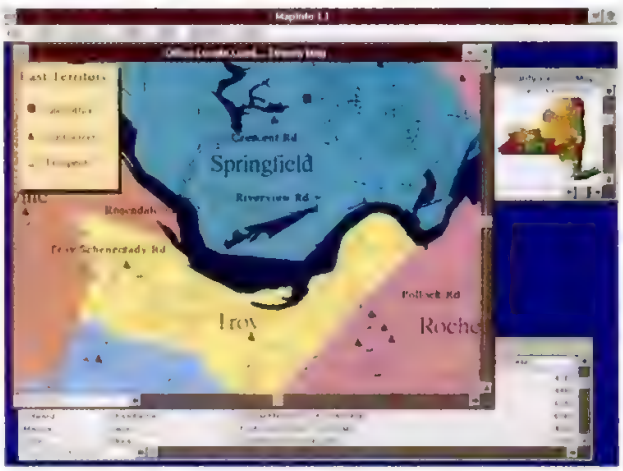

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we tested was susceptible to crashes, occasionally crashing, for example, when switching to and from the DOS 5.0 Shell. Microsoft acknowledges that there are bugs in the Shell, but *Netroom* was the only memory manager we tested that had trouble in this scenario. The Quantum feature also turned out to be incompatible with *FRAC*, one of our favorite games.

Compatibility problems can be system- and software-specific, and other systems with the same software may not behave similarly.

We found two errors in *Netroom*'s implementation of the extended memory specification (XMS), one of which might have the potential to affect allocation of UMB space by applications that try to access the area directly. Helix says it will fix these problems in the next version, which is set to ship soon.

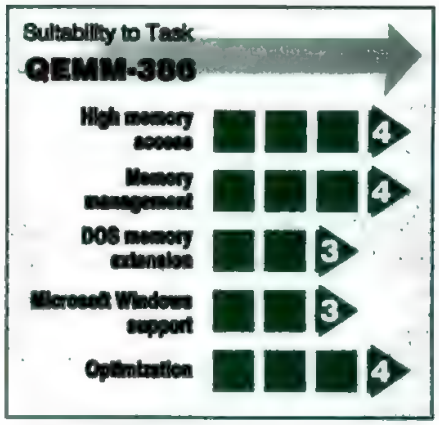
Netroom will provide some services on a 286 machine with a NEAT chip set or on any machine with LIM 3.2 or 4.0 memory, and Helix offers special network licenses. Networks are probably the best place to use *Netroom*. If you can use its Netswap capability for very large drivers, *Netroom*, which won a *PC Magazine* Editors' Choice for LAN memory management in 1991, remains the memory manager of choice.

QEMM-386

by Barry Simon

Judging by the number of competitive memory manager advertisements that mention Quarterdeck Office Systems' $99.95 *QEMM-386*, Version 6.0, you can tell that it's the market leader—and rightly so. *QEMM* provides superb memory management, and its innovative new Stealth feature lets it access more UMB space than any of its competitors. As an added benefit, the package includes *Manifest*, an Editors' Choice winner among reporting and optimization utilities (*PC Magazine*, March 26, 1991).

QEMM has all the basic features you expect in a memory manager and most of the advanced features you hope for. Many of these advances, such as a shared expanded/extended memory pool, were pioneered by Quarterdeck, which has also been a major force in setting up the Virtual Control Program Interface (VCPI) specification.



QEMM lets you put the basic DOS data structures in upper memory blocks (UMBs): FILES=, FCBS=, LASTDRIVE=, and with DOS 3.*x*, BUFFERS= as well. *QEMM* is the only memory manager that lets you use UMBs while running Windows in Standard mode. DR DOS will run Windows in Standard mode only if UMB support is disabled, while the

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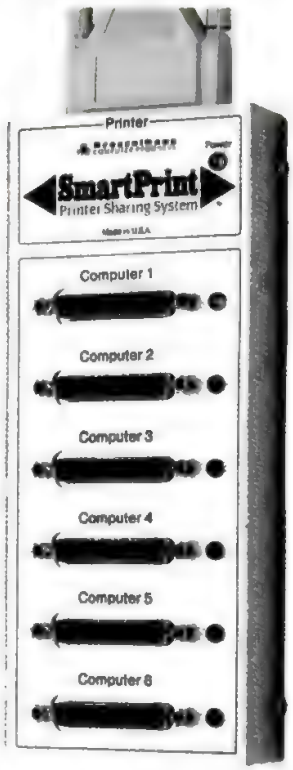

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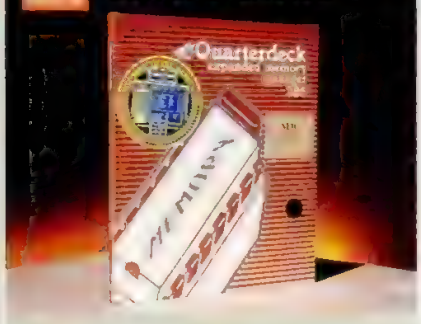

***QEMM-386*, Version 6.0**
Quarterdeck Office Systems Inc., 1901 Main St., Santa Monica, CA 90405; 213-392-9851.
List Price: $99.95
Requires: 1MB RAM, DOS 3.0 or later.
In Short: *QEMM-386*, Version 6.0, is well designed and includes just about every memory management extra you can think of. The most notable addition is its Stealth feature, which can increase UMB space by more than 80K.

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other mangers are restricted to Real and 386 Enhanced modes. *QEMM* works with Standard mode by patching into the Windows kernel as Windows loads—a potentially risky procedure but one that seems to work. All of the memory managers should be able to run Windows 3.1 in Standard mode.

STEALTH: MOVING SYSTEM BIOS

Undoubtedly, *QEMM*'s most spectacular feature is its Stealth mode. It works by freeing up address space normally used for the PC's ROM BIOS area, which allows you to store terminate-and-stay-resident programs and drivers in that space. Most PCs have 64K of system ROM BIOS code (PS/2s have 128K), and VGA systems typically have 32K of video ROM BIOS. You may have additional ROMs supplying the BIOS for a hard disk controller, network board, or scanner.

QEMM frees up the UMB space by storing the BIOS code in extended memory and swapping it into the EMS page frame when needed. *QEMM* needs to keep 13K of its own code in UMBs to monitor calls for BIOS services.

There's little doubt that Stealth adds precious UMB space for additional TSRs and drivers, but its memory reclamation powers may be a bit deceiving. On a typical system, the gain is 64K plus 32K of video ROM, a total of 96K. But since *QEMM* uses 13K of that space for itself, the net gain is 83K.

On many systems, the first 32K of system ROM is not used after bootup, and if you are willing to experiment with your CONFIG.SYS file, it could be recovered just by using DOS 5.0. On these systems, the gain could be interpreted as only 51K.

If you don't need an EMS page frame, you might actually do better without *QEMM*'s Stealth, since it needs a frame. But if you run programs that use EMS, Stealth will help you gain a substantial amount of extra space to load all the TSRs you want.

STEALTH: PERFORMANCE ISSUES

There are also performance issues connected with Stealth—effects that seem to be machine-dependent. On our test machine (a Compaq Deskpro 386/25), the throughput loss for DOS disk access is as much as 30 percent when comparing *QEMM* with and without Stealth. Subsequent informal disk access tests on a different PC revealed a much smaller effect, less than 5 percent. Testing also showed that direct BIOS screen writes take a performance hit under Stealth.

There have also been reports of more serious disk performance problems, but often these are on machines that need to have their interleaves increased. On these machines, before Stealth is installed, the controller can just barely recover from one disk read, in time to read the next sector. Stealth adds overhead to the process of the disk read, which can cause the controller to miss its opportunity to read data at the optimum time, and the disk then needs to make an extra revolution. A higher interleave can make the Stealth-equipped machine more efficient.

Another performance penalty concerns disk caches like *Super PC-Kwik* and *HyperDisk* (but not DOS's SMARTDRV). These caches rely on BIOS services that *QEMM* automatically turns off for safety's sake. So when released, *QEMM* forces these caches' advanced modes to be turned off. However, Quarterdeck provides programming hooks that the caches can use to get the BIOS services through another route.

Super PC-Kwik recently released a new version with Stealth-compatible advanced support; other caches are likely to follow. The bottom line is that for many systems, Stealth will work with a tolerable performance loss if you want to try to squeeze out that extra space for TSRs.

Manifest, the reporting component of the package, is a visually attractive, well-thought-out program that provides complete memory and hardware information. In addition to *QEMM-386*, Quarterdeck has *QEMM 50/60* for 286-based PS/2s and *QRAM* for 286 machines with supported chip sets.

If you are a TSR user and your system can run Stealth, *QEMM-386* is the memory manager of choice. Even if you can't run Stealth or don't need the extra UMB space, *QEMM-386*'s feature mix and experienced engineering make it a top choice for your memory management needs.

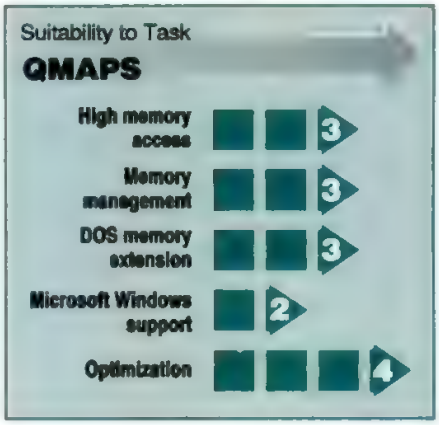
QMAPS

by Greg Pastrick

Quadtel Corp. bills *QMAPS*, Version 2.0, its first retail product, as a premium memory management system. Its high performance and relatively steep $129.95 price tag seem to bear that statement out.

Though it's a first for Quadtel, it does have a lineage. *QMAPS* and *UMBPro*, an $89.95 extended memory specification (XMS) driver and HIMEM.SYS replacement, are born of a line of Quadtel OEM products that include system and video BIOS software and LIM 4.0 drivers. Some of that technology and experience has been assimilated in *QMAPS*.

Aside from its remarkably smooth installation on our test system, the software has some intelligent tools that can detect the presence of network cards or other adapters and can size up drivers, programs, and terminate-and-stay-resident programs for high loading. *QMAPS* also



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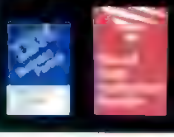

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extends DOS 5.0 services with disk caching, a RAM disk, and print spooling, and it can even be configured to use DOS 5.0's LOADHIGH feature to load devices and TSRs into upper memory blocks (UMBs).

The installation is notable for its simplicity. All that's required by the routine is a line for DOS=HIGH in the CONFIG.SYS file. Once you answer a series of screen prompts, *QMAPS* automatically installs and configures the driver.

Among the values defined during setup, *QMAPS* configures the system for shared expanded/extended memory usage and excludes EMS mapping to ROM and video RAM areas. Beyond the basic default parameters, switches for copying BIOS code from ROM to fast RAM and accessing video RAM space can be edited into the CONFIG.SYS file.

COMMAND LINE CONTROL

A number of program control options can be executed from the command line. For example, the 96K of unused video graphics memory can be allocated to system memory by typing QMAPS VON or VOFF at the command line. All values are saved to an editable control file called QMAPS.INI. System status and display of memory usage can be brought to screen by entering QMAPS at the command line.

QMAPS really begins optimizing memory when you use its SMARTMOV utility. Remember, though, SMARTMOV can be used only after the memory driver has been initialized for the system and UMBs have been created. It can be executed either from the command line or from the installation menu. SMARTMOV methodically analyzes batch files, drivers, programs, and TSRs contained in the AUTOEXEC.BAT or CONFIG.SYS for the best fit and loading order into upper memory.

Using a series of reboots, SMARTMOV determines memory usage and assigns the appropriate UMBs for high loading. It's an efficient operation that automatically edits and inserts the *QMAPS* load high (QLH) command with the UMB specifications and saves all the information to its own reference file.

Much like a memory manager's driver parameters and specifications, QLH driver specs can be edited for fine-tuned memory usage. Among these, the LOADEXTEND command, which temporarily uses the 64K EMS page frame for program initialization, is probably the most important. Since it is not a default value and needs to be entered manually, LOADEXTEND requires only that the page frame address be located at the end of the UMB where you want to load a specified program.

MODEST MEMORY GAINS

Despite *QMAPS*'s sophistication and ease of use, it did not deliver more memory for the money. When we used its defaults, gains in conventional memory on our fully loaded test platforms were modest at best. On the standalone system, the program leaves 595K of lower memory free, and on the network side, this dropped to 528K. In systems where large programs such as IPX and NETx exist, LOADEXTEND must be enabled to realize significant gains in conventional memory space. However, *QMAPS*' performance on our suite of EMS tests on both platforms rates clearly superior to that of all the other memory mangers we evaluated except for *QEMM-386* with Stealth implemented. It's a tribute to the efficiency of the *QMAPS* driver, and certainly solid ground for Quadtel to build on for future *QMAPS* releases.

QMAPS, Version 2.0
Quadtel Corp., 3190-J Airport Loop Dr., Costa Mesa, CA 92626; 714-754-4422.
List Price: $129.95; *UMBPro* 2.0, $89.95.
Requires: 1MB RAM, DOS 3.0 or later.
In Short: When used with DOS 5.0 or with its own *UMBPro* upper memory management partner, *QMAPS*, Version 2.0, performs efficiently in maximizing conventional memory and implementing EMS and XMS.

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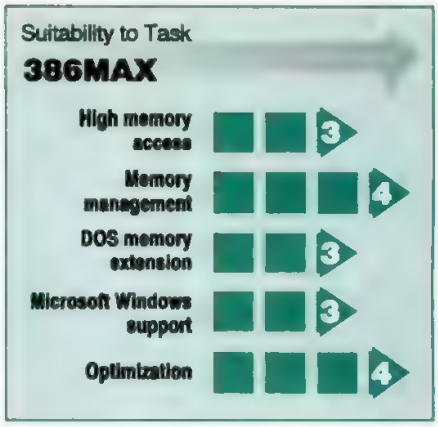
386MAX

by Barry Simon

Qualitas's *386MAX* was the first 386 memory manager on the market, and its initial set of features set a standard for this entire class of products. In its current incarnation, the $99.95 *386MAX*, Version 6.0, is stronger than ever and especially noteworthy for its installation features and DOS/protected-mode interface (DPMI) support (a companion product, *BlueMAX*, is sold to users of Micro Channel machines).

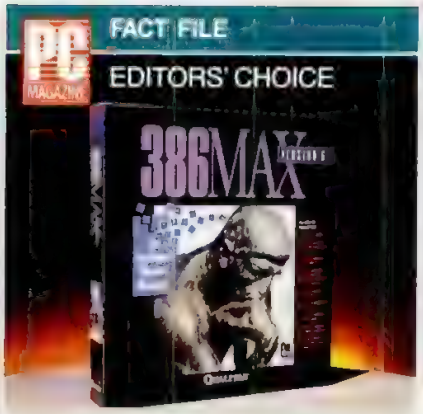


386MAX has long provided all the basics. It loads terminate-and-stay-resident programs and drivers high in a user-specified region. Qualitas was actually the first to introduce a feature called FlexFrame, which allows TSRs to use the expanded memory area during loading as long as they subsequently shrink and reside below that EMS area. It also has long supported EMS, extended memory, VDS, and the Virtual Control Program Interface (VCPI).

Version 6.0 boasts a number of features that catch up with and in some cases surpass those of *QEMM-386*. Like other memory managers, *386MAX* has a shared pool of memory for EMS and extended memory, but it goes a step further, offering support for DPMI. While its memory reporting program (*ASQ*) is not as well designed as *QEMM*'s *Manifest*, *386MAX* makes up for this in practicality, with lucid help and tutorial information that can turn you into a memory maven.

Unlike *QEMM-386*, which uses *Manifest* after boot-up to determine if part of your BIOS region is unused, *386MAX* automates the search and performs it during installation. Prior to Version 6.0, *386MAX* had a reputation for slow handling of extended and expanded memory, but our tests show Qualitas has fixed this in the new version.

The key area where *386MAX* does not match *QEMM* is in recovering the entire ROM BIOS region. *386MAX* does make a gesture towards this service with a VGA Swap feature that moves the VGA BIOS to the B000–B800 region. This works in sys-



386MAX, Version 6.0
Qualitas Inc., #1386, 7101 Wisconsin Ave., Bethesda, MD 20814; 800-676-0386, 301-907-6700.
List Price: $99.95; *BlueMAX* (for Micro Channel architecture machines), $124.95.
Requires: 256K extended memory, DOS 3.0 or later
In Short: *386MAX* is a well-designed memory manager notable for its DPMI support. Its automatic memory optimizer is one of the best and one of the easiest to use.

CIRCLE 464 ON READER SERVICE CARD

tems without dual monitors or super VGAs, which use this memory area when they are in ultra-high-resolution modes (1,024 by 768 and up). By defragmenting the UMB region, VGA Swap makes the typically isolated 32K more usable. But it falls short of *QEMM*'s Stealth technology, which successfully remaps DOS's 64K BIOS code, in addition to video BIOS.

DPMI support, unique to *386MAX*, is one of its most important features. Both Microsoft Windows and OS/2 2.0 give DOS applications access to extended memory via DPMI, so programs that can use it should soon appear. For now, most DPMI applications also support VCPI and work with other memory managers. The main exception is Borland's *Turbo Debugger*, which in 386 Enhanced mode will run only with *386MAX*.

SPECIAL WINDOWS SUPPORT

386MAX's Windows support is another special feature. *Memory Commander* and *386MAX* are the only memory managers that support instancing of loaded TSRs; that is, they keep a separate copy of the TSR code in each DOS partition. Without instancing, you'll probably crash whenever you pop up a TSR in one DOS window, switch to another DOS window, and try to pop up the same TSR. Unique to *386MAX* is *Virtual High DOS*, which allows you to load TSRs into high DOS within individual DOS windows.

Special care has been taken in the program's method of automatic optimization of your free UMB region. Like many of its competitors, *386MAX*'s Maximize program reboots the machine, but its use of a special replacement COMMAND.COM (written by the authors of *4DOS* and *NDOS*) to allow it to track nested and chained batch files is unique. Maximize will even attempt to reorder TSR load order intelligently to improve utilization of the UMB region.

Included is a special editor for CONFIG.SYS and AUTOEXEC.BAT that allows you to use a single keystroke to toggle the load command for a TSR between UMB and conventional memory. The package also includes a disk cache called Q-Cache.

While *386MAX* will run on IBM PS/2s, you'll want the special *BlueMAX* version if you have one of those machines. This is a superset of *386MAX* with several PS/2-specific features. PS/2s have ROMs in the top 128K, and *BlueMAX* can recover 80K to 84K of this memory. Owners of 286 systems with appropriate chip sets can also get memory management from *386MAX*. There used to be a separate product called *Move'em*, but its capabilities have since been blended into the 386 product.

386MAX is of special interest to programmers who debug their own programs since there is support for *Turbo Debugger/386*. In addition, you'll find special hooks in the software version of The Periscope Company's *Periscope* debugger that allow it to use *386MAX* managed memory to decrease its below-1MB memory hit to a mere 32K.

386MAX is rather like the Mercedes that used to appear in Qualitas's ads. It has solid engineering and quality built-in, but at the same time, it is a somewhat stolid choice. Those who don't mind a slightly more radical approach might want to look at the sportier *QEMM-386*, whose Stealth technology can squeeze out more memory. But if your ultimate goal is a supremely stable environment, *386MAX* should be on your short list of memory managers. ■

Barry Simon is a contributing editor of PC Magazine. *Greg Pastrick is a Massachusetts-based free-lance writer and frequent contributor to* PC Magazine.

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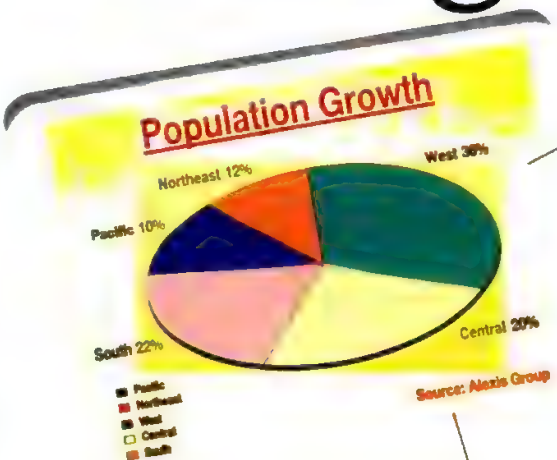

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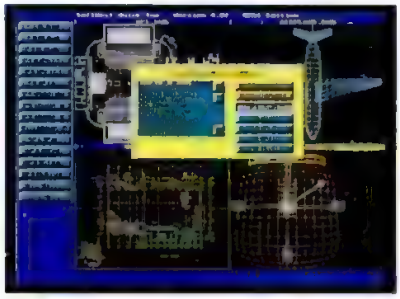
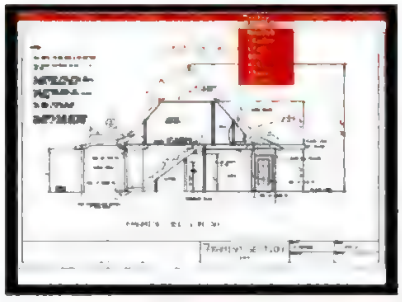


19 PROGRAMS THAT BUILD ON AUTOCAD

AutoCAD is the dominant CAD program in the world today, but hundreds of add-on programs from independent developers helped it to get there.

BY DAVID COHN



For many who use it, *AutoCAD* is more than just a computer program: It's a way of life. Offices once filled with drafting tables and T squares are now occupied by rows of personal computer design stations. And Autodesk's *AutoCAD* is the program running on more than 70 percent of those stations.

While not the first CAD package available for the PC, *AutoCAD* stood out from the beginning, because it offered users the ability to customize many of its features. That prompted many early customers to experiment,

DISPLAY-LIST DRIVERS: Moving Around AutoCAD in Real Time

by David Cohn

Using a CAD program's pan-and-zoom functions usually results in long delays while *AutoCAD* reconstructs or *regenerates* the drawing from its binary database. To alleviate this problem, graphics card companies borrowed technology from earlier turnkey CAD systems and began producing boards that utilized dedicated graphics coprocessors and on-board memory to store the vectors that comprise the drawing in a display list. Rather than relying on the CPU to process the drawing file, the system could use the graphics card to manipulate this list independently, resulting in nearly instantaneous pans and zooms in many instances.

Unfortunately, when these display list–based boards first appeared, *AutoCAD* did not support display-list processing. Thus, early display-list boards had to trick *AutoCAD*, and most were very expensive.

In 1989, however, the *AutoCAD* display-list market took off. The combination of a VGA graphics card and driver software written to the latest Autodesk Device Interface (ADI) yielded the performance you would expect from expensive graphics boards at prices below $500.

Today, display-list drivers for *AutoCAD* are quite common. No fewer than eight companies currently market software that will supercharge your graphics board for use with *AutoCAD*.

In fact, most sophisticated graphics cards now ship with an *AutoCAD* ADI driver, usually a slightly less feature-rich version of a driver from one of the same eight companies. Using a display-list driver on a Super VGA board at 800-by-600 or 1,024-by-768 resolution comes so close to the power of high-priced coprocessor-based boards that many high-end board manufacturers now market their own VGA display-list drivers, and they sell more copies of their driver software than graphics boards.

High-end boards certainly still have their place, but they are purchased more for their other capabilities—such as super-high resolution, 24-bit color, and frame buffers—than for their ability to do fast pans and zooms. And next to drawing viewers, VGA display-list drivers are currently the hottest market for *AutoCAD* add-on software. If you are not using one already, any of these drivers represents a good way to make your *AutoCAD* system more productive. ■

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AutoBoost Inc., 8 Phoenix Pl., Andover, MA 01810; 508-475-8694.
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Auto-Plus
Metheus Corp., 1600 NW Compton Pl., Beaverton, OR 97006-6905; 503-690-1550.
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DLD
Panacea Inc., Post Office Sq., #4, 24 Orchard View Dr., Londonderry, NH 03053-3376; 603-437-5022.
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Focus
Video Seven, 5150 El Camino Real, Suite B-21, Los Altos, CA 94022; 415-967-9445.
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GT Express
Artist Graphics, 2675 Patton Rd., St. Paul, MN 55113; 612-631-7800.
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Lightning Zoom!
Martin Sales International, 824 Charnelton St., Eugene, OR 97401; 503-344-1154.
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Nth Drive
Nth Graphics, 1807-S W. Braker Ln., Austin, TX 78758; 512-832-1944.
CIRCLE **509** ON READER SERVICE CARD

Soft Engine
Vibrant Graphics, 12741 Research Blvd., Austin, TX 78759; 512-250-1711.
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first altering the program's menu structure, and later writing scripts and custom macros to speed up repetitive tasks. In 1986, Autodesk added a complete programming language, AutoLISP, which further enhanced *AutoCAD*'s customization capabilities. With AutoLISP, users could add new commands to the program—to delete all drawing entities of a particular type or automatically save a drawing after a specified interval, for example—thus tailoring the package to fit their individual needs.

In Release 11, Autodesk has gone further, adding a new programming interface, the AutoCAD Development System (ADS), that lets developers write more complex applications in high-level programming languages such as C; the applications can then be loaded and called using AutoLISP functions. An example is Autodesk's own solids-modeling software, *Advanced Modeling Extension (AME)*, which is available as an option for Release 11.

AUTOCAD AS GRAPHICS ENGINE

AutoCAD is often referred to as a *graphics engine*. It provides the basic ability to draw and edit lines, arcs, and text (a total of 17 different types of drawing entities), but it offers little added advantage to the draftsman who uses it right out of the box. Around that engine, however, independent developers can build a variety of applications. Software designed for specific *vertical-market* design disciplines customizes *AutoCAD* for specific tasks.

Beyond its use in such fields as architecture and engineering, you can find *AutoCAD* in the offices of cartographers, boat builders, technical illustrators, land managers, and medical engineers. The specific drawing needs of these various professions are, of course, quite different; add-ons adapt *AutoCAD* to facilitate what is needed. For example, parallel lines may represent a wall to an architect; to a cartographer, they may represent a roadway. Once the lines are on paper, the observer can determine their meaning, but while the drawing is being created, the draftsman should not have to think about what those lines mean. Indeed, he should no longer need to draw two individual lines. With the right add-on program, the architect need only draw *walls;* the cartographer, *roads*.

Yet these vertical markets represent just a portion of the available offerings. A very different category of add-ons pro-

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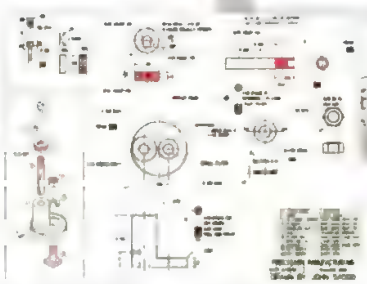

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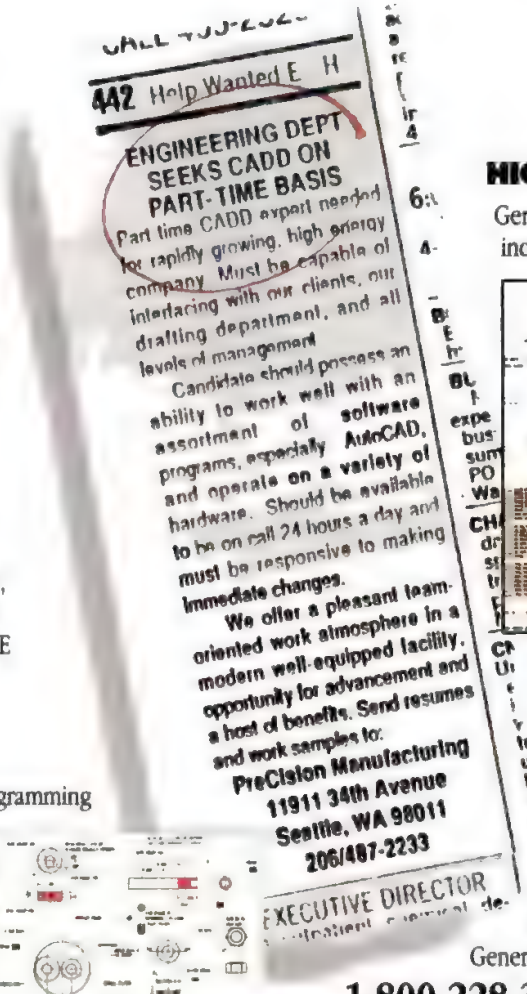

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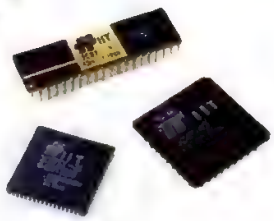

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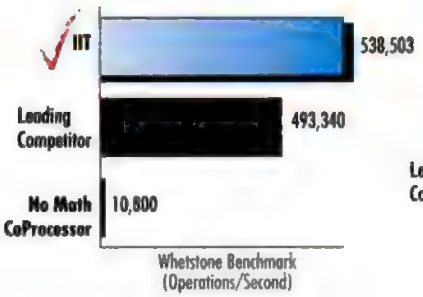

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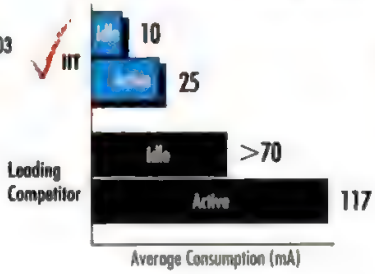

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vides important generalized features missing from *AutoCAD*, as opposed to those aimed at specific disciplines. These *horizontal* utilities include such items as text editors, fonts, hatch patterns, links to external databases, and file managers that let you view and manipulate *AutoCAD* drawing files without having to load *AutoCAD*. While vertical-market applications appeal only to users within the targeted markets, these general utilities are useful to virtually anyone who uses *AutoCAD*, and they may even be valuable to those who don't use the program but work closely with others who do.

Horizontal *AutoCAD* utilities are nearly as numerous as specialized vertical-market applications. *PC Magazine* counted no fewer than 300 general-purpose utilities among more than 1,000 third-party programs listed in Autodesk's *AutoCAD Resource Guide*. These included seven packages of fonts or hatch patterns; five plot spoolers; ten programs for editing and managing shapes, fonts, and menus; and ten graphics display drivers that vastly increase the speed of VGA graphics boards when used with *AutoCAD* (see the sidebar "Display-List Drivers: Moving Around AutoCAD in Real Time"). The guide also includes examples of two especially popular kinds of *AutoCAD* utilities: the ten file-viewer/drawing-management programs and the nine text editors reviewed on the following pages. Because these products differ so greatly in their intended purpose, we chose not to award an Editors' Choice in either category.

DRAWING VIEWERS

Visual File Management

by David Cohn

Almost as soon as drafting departments began switching to CAD, a problem arose for managers: In the paper-and-T-square era, the boss could wander around the drafting room and look over shoulders to see how a drawing was progressing. That all changed with the move to CAD.

The casual glance over the drafter's shoulder was replaced by a puzzled stare at a CRT. It is difficult to view an entire 24-by-36-inch drawing within the confines of a monitor. And if you've forgotten the exact filename of the drawing you are looking for, you may need to load drawing after drawing, typing each filename at *AutoCAD*'s main menu until you find the right one.

A number of developers rose to the occasion, creating programs that let you display *AutoCAD* drawing files much more quickly by simply highlighting filenames, without the need to load *AutoCAD* first. This was no easy feat. Autodesk has never published specifications for its .DWG file format, and in fact, the company has changed that format with each release of the program as new features were added. Thus, developers have had to reverse-engineer their viewing utilities—and keep up with constant change.

GETTING AROUND

To make them truly useful, most developers strove to make their *AutoCAD* draw-

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Most developers strove to make their drawing viewers easier to use than AutoCAD itself.

ing viewers easier to use than *AutoCAD* itself. And to transcend the confines of the CRT, the drawing viewer really has to let you pan and zoom about the drawing file, just as *AutoCAD* does.

Instead of an entire drawing, though, you may often need to locate a single block—a collection of entities saved as a unit—that you would reuse if only you could find it. Most drawing viewers, therefore, give you the ability to display individual blocks within a drawing and to turn individual layers on and off.

As competition among these programs has heated up, developers have added other features. For example, most let you copy, rename, or delete files simply by clicking on their filenames with a mouse. Others can quickly produce a print or plot of any drawing. Still other programs let you dispense with the need for check prints entirely by adding nondestructive "redline" notes that the draftsman will see the next time the drawing is loaded.

TOTAL DRAWING MANAGEMENT

Some programs even include a complete drawing database, letting you search for those missing drawings both visually and via database queries. Two programs not included in this review, *AutoBase* (from Cyco International, Atlanta, Georgia; 404-634-3302) and *AutoEDMS* (from ACS Telecom, Lomita, California; 213-325-3055) are actually complete graphics-based relational database programs with integral drawing viewers.

Not all drawing viewers are created equal, however. Indeed, some developers have deciphered the .DWG file format more adequately than others, and Autodesk continues to complicate their jobs. *AutoCAD*, Release 11—the latest version of the program—adds several new features that confound many of the viewing programs. The most troublesome, called *paper space*, enables *AutoCAD* to display multiple views of a drawing on-screen at once, exactly as it will later be plotted. Another, *reference files*, lets you include several external files in a master drawing without actually loading the referenced drawings' entities; this is similar to dynamic data exchange (DDE) under Windows.

Add to this mix the desirability of being able to display formats besides .DWG, plus the need for each developer to invent its own graphical user interface (one viewer runs under Windows, and none look much like *AutoCAD*), and you have a very broad feature set. Yet if you use *AutoCAD* or work with *AutoCAD*-related files, you do need a drawing viewer—and one of these ten programs will probably meet your needs, though none of them are right for everybody.

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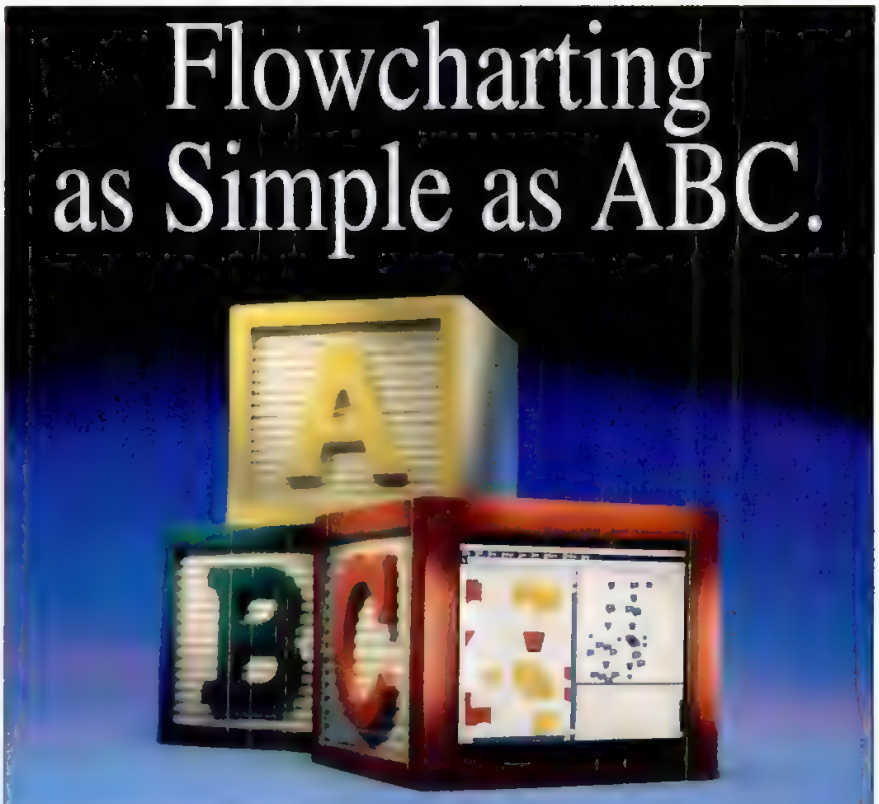

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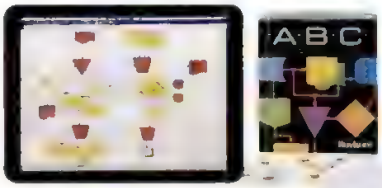

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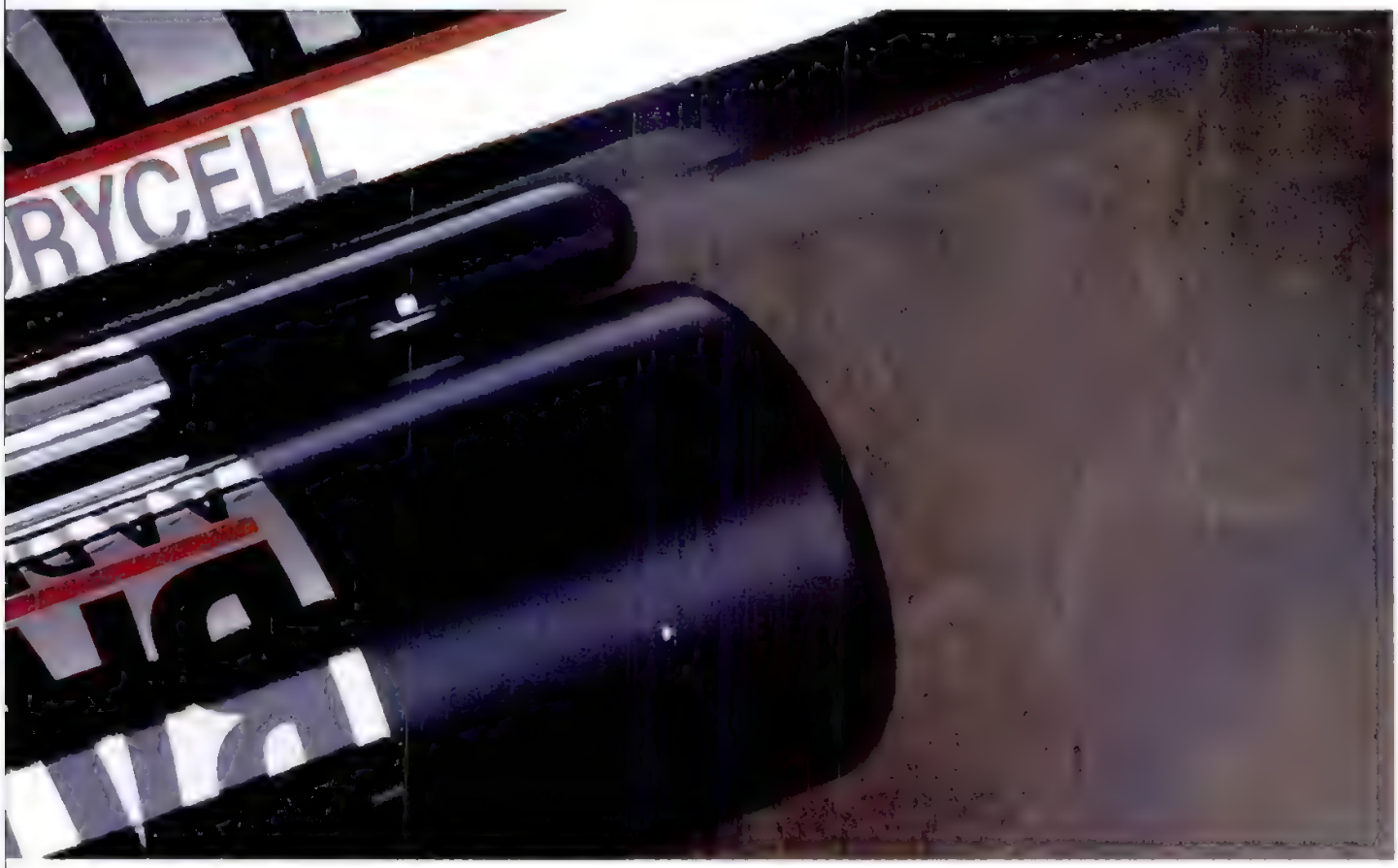

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CIRCLE 197 ON READER SERVICE CARD

AUTOCAD UTILITIES: DRAWING VIEWERS

AutoManager Professional

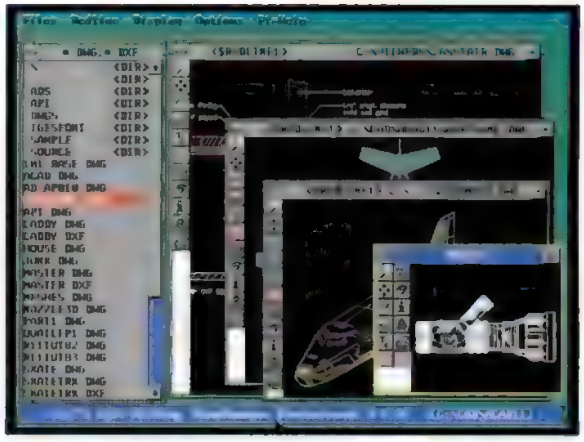
Cyco International's *AutoManager Professional* ($495) boasts an impressive pedigree. Its predecessor, *AutoManager*, was the first add-on program designed to display *AutoCAD* drawing files. This new version builds on that tradition, adding .DXF viewing, redlining, and the ability to print and plot. It is easy to use and gets drawings on-screen quickly.

Initially, the program's Windows-like screen shows a single graphics window, but you can open additional windows to display multiple drawings—as many drawings as memory permits. You can tile, overlay, move, and resize these windows using a mouse.

AutoManager Professional has no trouble displaying reference files, but it does not currently support *AutoCAD*'s paper space entities. (By the time you read this, Cyco expects to have rectified that shortcoming.) And though it can use *AutoCAD* fonts for redlining, it has difficulty displaying some of that program's text fonts.

When you exit *AutoManager Professional*, you can leave it loaded as a 20K TSR and later activate it from within *AutoCAD* to insert drawings as *AutoCAD* blocks. Several supplied keyboard macros and scripts also let you start *AutoCAD* to edit the drawing currently being displayed and run the Cyco program as a TSR; you can even pop up *AutoManager Professional* while running programs other than *AutoCAD*.

Its ability to remain in memory and available at all times makes *AutoManager Professional* a versatile program. Aside from its current lack of paper space support, *AutoManager Professional* is a winner.



Many *AutoManager Professional* functions are accessible by clicking on the icons attached to each window.

***AutoManager Professional*, Version 4.22**
Cyco International, 1908 Cliff Valley Way, #2000, Atlanta, GA 30329-9819; 404-634-3302.
List Price: Single user, $495; network version, $995.
Requires: 1MB RAM, DOS 3.1 or later.
CIRCLE 513 ON READER SERVICE CARD

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AutoSight Access

AutoSight Access ($299) aspires to be more than just a drawing viewer. AutoSight has added options such as file conversion and revision control to the usual features; unfortunately, in the process the vendor has shortchanged us in terms of the capabilities for viewing drawings.

The program can display .DWG, .DXF, HPGL, and .PCX files. But *AutoSight Access* can only display three-dimensional drawings in plan view; it cannot display shape entities or paper space entities or line types in their true appearance. It does, however, handle reference files.

AutoSight Access **uses a *GEM*-like interface but fails to sort files and subdirectories separately, making it hard to maneuver through the file list.**

The program's strong suit is its ability to display revisions for comparison. It overlays images on top of each other using different colors, making it easy to see changes. It also lets you convert files between different versions of *AutoCAD*, or convert a .DXF or HPGL plot file into an *AutoCAD* drawing file, which is useful as a last-resort file-recovery technique.

Loading files is a bit more cumbersome than necessary; you must reconfirm the file extension before the program will display its file-selection dialog box. Rather than a file list, *AutoSight Access* uses folder and file icons reminiscent of the *GEM* interface, and you may need to scroll through very large displays to find the file you need.

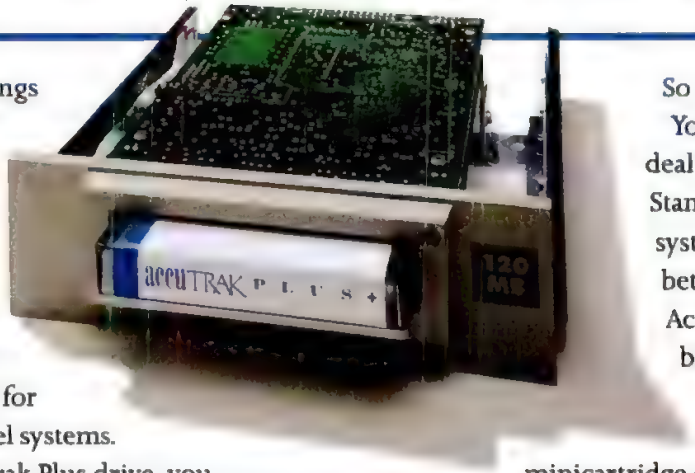
Its inability to display the complete set of *AutoCAD* drawing entities makes *AutoSight Access* difficult to recommend as a drawing viewer. For file-conversion and revision-control capabilities, though, it's hard to beat.

***AutoSight Access*, Version 3.0**
AutoSight Inc., P.O. Box 362086, Melbourne, FL 32936; 407-242-5865.
List Price: Single user, $299; five users, $899; ten users, $1,499.
Requires: 640K RAM, DOS 3.0 or later. 750K hard disk space, color VGA, pointing device recommended.
CIRCLE 514 ON READER SERVICE CARD

AutoView Plus

Simplicity need not mean low functionality, as demonstrated by MarComp's *AutoView Plus* ($195). This well-organ-

At $379 It's Even Better.



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Crisp and Clean Fax
The 9624LE Plus has Group 3 send and receive fax at 9600 bps. Easy-to-use fax software allows you to send crisp and clean faxes directly from your PC, which means you'll never have to wait in line at the fax machine again.

DSI

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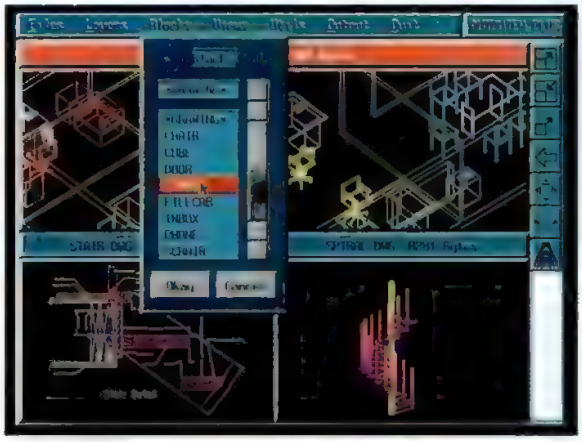
CIRCLE 186 ON READER SERVICE CARD

ized viewing program may not have the richest feature set around, but it can easily handle most *AutoCAD* entities.



This program's simple design makes it easy to use. *AutoView Plus* lets you display individual block entities within any *AutoCAD* drawing.

The main screen consists of seven pull-down menus, which you can navigate via mouse, arrayed above a single display window. You can split this window into a maximum of four separate windows, each displaying a separate .DWG file. Currently, *AutoView Plus* can display only *AutoCAD* .DWG files. By the time you read this, though, Version 3.8 of the program should be available, and it will display .DXF files.

Seven icons along the right of the screen let you zoom in or out, pan, display the previous view, rotate the drawing in 3-D, or load the current drawing into *AutoCAD*. Not all of these features work as well as they should, though. To zoom out to the drawing's extents, you must select *PLAN/EXT* from the Views pull-down menu (which is hardly intuitive). And while you can rotate a 3-D drawing about any axis, there is no way to specify a 3-D viewpoint. For all its limitations, it may still merit a try. To its credit, *AutoView Plus* displays most entities properly and even handles paper space and reference files. It is reasonably priced, has a clean interface, and should serve quite well if you only need to view drawing files.

***AutoView Plus*, Version 3.75**
MarComp, 13 Lauriann, #100, Parkton, MD 21120; 301-343-2743.
List Price: $195.
Requires: 640K RAM, 1MB hard disk space, DOS 3.0 or later. Pointing device recommended.
CIRCLE 515 ON READER SERVICE CARD

AutoVue

If speed is more important to you than the display of shape entities, turn to Cimmetry Systems' *AutoVue* ($250). This drawing viewer is part of a product line that includes a redlining program (*AutoVue Redline*, $400) and a complete drawing database management program (*AutoVue InteGrator*, $450).

AutoVue may seem rough around the edges, but it gets drawings on-screen faster than most programs in our roundup. You can configure it for a mouse or one of several digitizers. The package also supports a variety of graphics cards, printers, plotters, and ADI drivers, including *AutoCAD* ADI digitizer drivers.

***AutoVue* displays six raster formats (.PCX, for example) in addition to *AutoCAD* drawings, slides, .DXF files, and plot files.**

While we were unable to get *AutoVue* to display shape files properly, it does handle paper space and reference files flawlessly. The program also displays more file formats than most. On the output side, the program can convert any displayed image into CalComp, .DXF, or HPGL vector formats, making it useful as a raster-to-vector conversion program as

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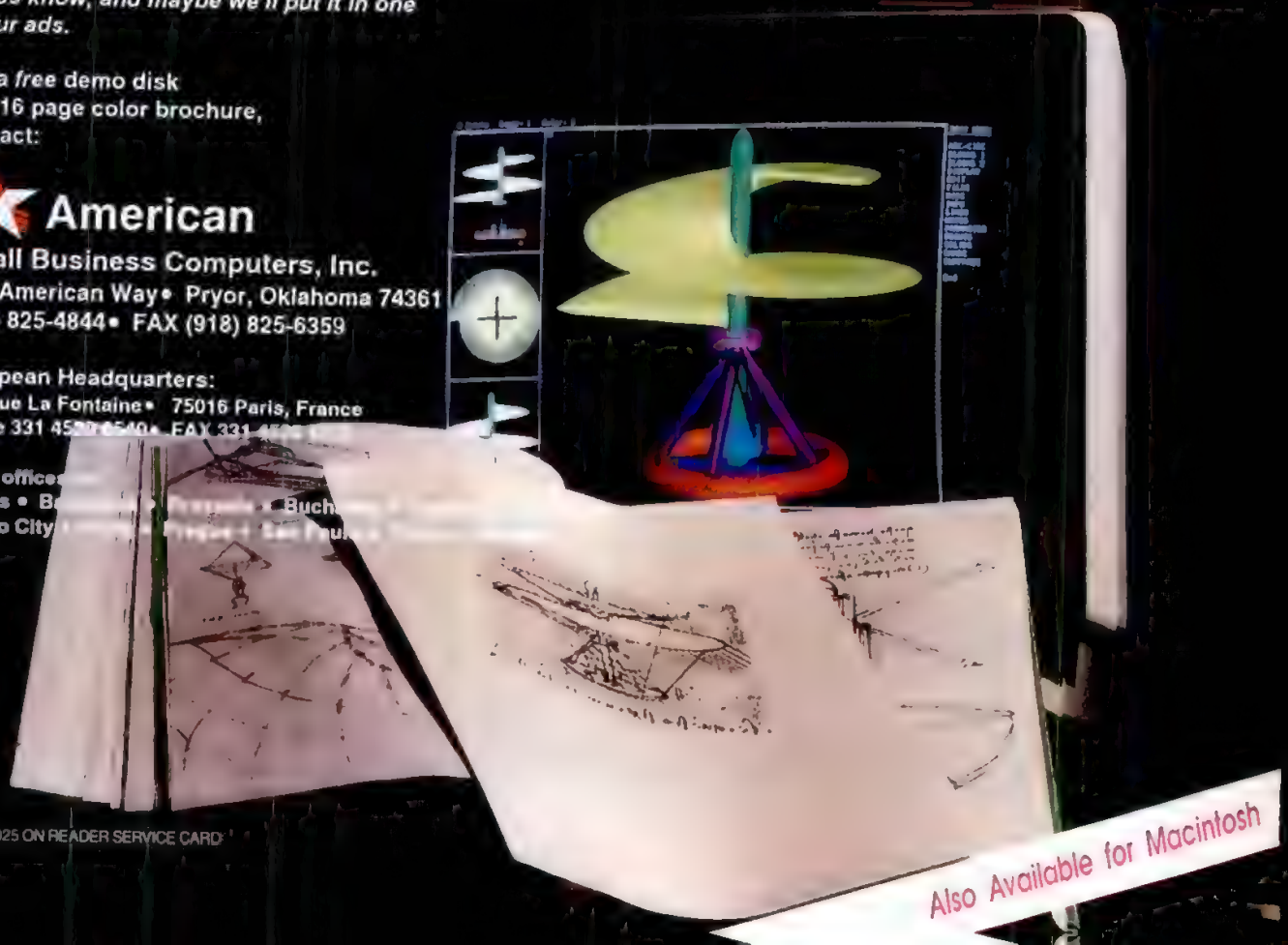
Mexico City [illegible]



CIRCLE 025 ON READER SERVICE CARD

Also Available for Macintosh

well. The resulting vector files may contain many short vectors, though.

AutoVue has two additional features that are found only in a handful of other viewing programs: an overlay command, which lets you load a second drawing on top of one already being displayed, and the ability to manipulate multiple viewports individually. Version 11.4, which did not ship in time for this review, adds a number of new conversions as well. Both DOS and Windows versions are available.

If being able to display several types of raster and vector file formats quickly is your main concern, *AutoVue* may be just what you need.

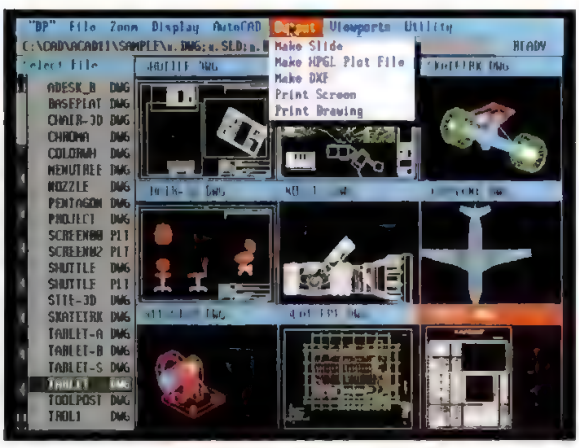
***AutoVue*, Version 11.2**
Cimmetry Systems Inc., 1430 Massachusetts Ave., #306, Cambridge, MA 02138; 800-361-1904, 514-735-3219.
List Price: $250; *AutoVue Redline*, $400; *AutoVue InteGrator*, $450.
Requires: 386 PC or better with 640K RAM, 1MB hard disk space, math coprocessor, DOS 3.3. Pointing device recommended.
CIRCLE 516 ON READER SERVICE CARD

Drawing Librarian Professional

SoftSource's *Drawing Librarian Professional* provides just about everything you could possibly ask for in a drawing viewer/management program. This $500 top-of-the-line package builds on the company's Windows version and versions for Unix-based workstations, adding redlining, embedded links, and a complete scripting language. SoftSource is constantly enhancing *Drawing Librarian Professional*, and in this latest release has perfected the display of both paper space and *AutoCAD*'s reference files.

Drawing Librarian Professional *provides an array of redlining and linking features.*

The drawing display window can be divided into 4, 9, 16, or 25 separate windows. User-definable file masks let you display one or more file types; files are displayed in the current window as soon as you select them. But you can also customize the program using its built-in scripting language. You can change the menus and disable and remove features. In fact, CAD managers can write complete menu-based applications to automate complex functions for inexperienced users, allowing *Drawing Librarian* to serve as a complete front end for their *AutoCAD* systems. *Drawing Librarian* has no problems displaying drawing entities, except for polylines with varied line types, which display as continuous polylines. And while the program is already one of the fastest at getting drawings on-screen, you can turn off the display of true fonts and solid fills to speed it further.



***Drawing Librarian Professional*'s screen can be divided into as many as 25 viewports. You can save any viewport as a slide, .DXF, or HPGL plot file, or output it to a printer.**

A CAD manager's dream, *Drawing Librarian* provides an excellent array of redlining and linking features. Anyone with a PC can view an *AutoCAD* drawing and add revision notes. These notes are stored in a separate file that automatically loads whenever the original file is viewed using *Drawing Librarian;* the redline information can also be merged into a separate layer within the *AutoCAD* drawing.

Drawing Librarian Professional also lets you group files into projects, extract drawing attributes to a comma-delimited or Lotus-compatible database format, rotate 3-D objects in real time, and archive files with a single pick. You would be hard-pressed to find another viewing package at any price that offers as much while remaining easy to use.

***Drawing Librarian Professional*, Release 1991.7**
SoftSource Inc., 301 W. Holly, Bellingham, WA 98225; 800-626-0999, 206-676-0999.
List Price: $500 per user; 5 users or more, $250 each.
Requires: 640K RAM, 1MB hard disk space, math coprocessor, DOS 3.0 or later.
CIRCLE 517 ON READER SERVICE CARD

FastLook Plus

FastLook Plus ($295) is the only drawing viewer in this roundup that runs under Microsoft Windows. This is both a blessing and a curse. On the plus side, the program makes excellent use of the Windows screen. The seven pull-down menus are supplemented by ten command buttons that let you view blocks and layers, zoom in and out, and toggle the redlining feature. (A DOS version of the program comes with a runtime copy of Windows 2.0.) On the other hand, Windows slows down what should be a speedy program.

FastLook Plus displays only one drawing at a time, but it is a simple matter to start a second copy of the program in another window. In our experience, the program proved unable to display saved views; it also had problems handling individual blocks. When you try to look at the blocks, for example, the drawing is blank until you zoom to its extents. Once in block mode, you'll need to reload the drawing in order to view it as a whole. Fortunately, *FastLook Plus* has no problems working with paper space entities or reference files.

The program's redlining feature works flawlessly. It automatically saves notations in a separate file that can be imported into *AutoCAD* or deleted when it is no longer needed.

FastLook Plus does gain some power from Windows (it's very easy to copy a portion of an *AutoCAD* drawing to the

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-- PC Week

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-- PC Magazine

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-- Macworld

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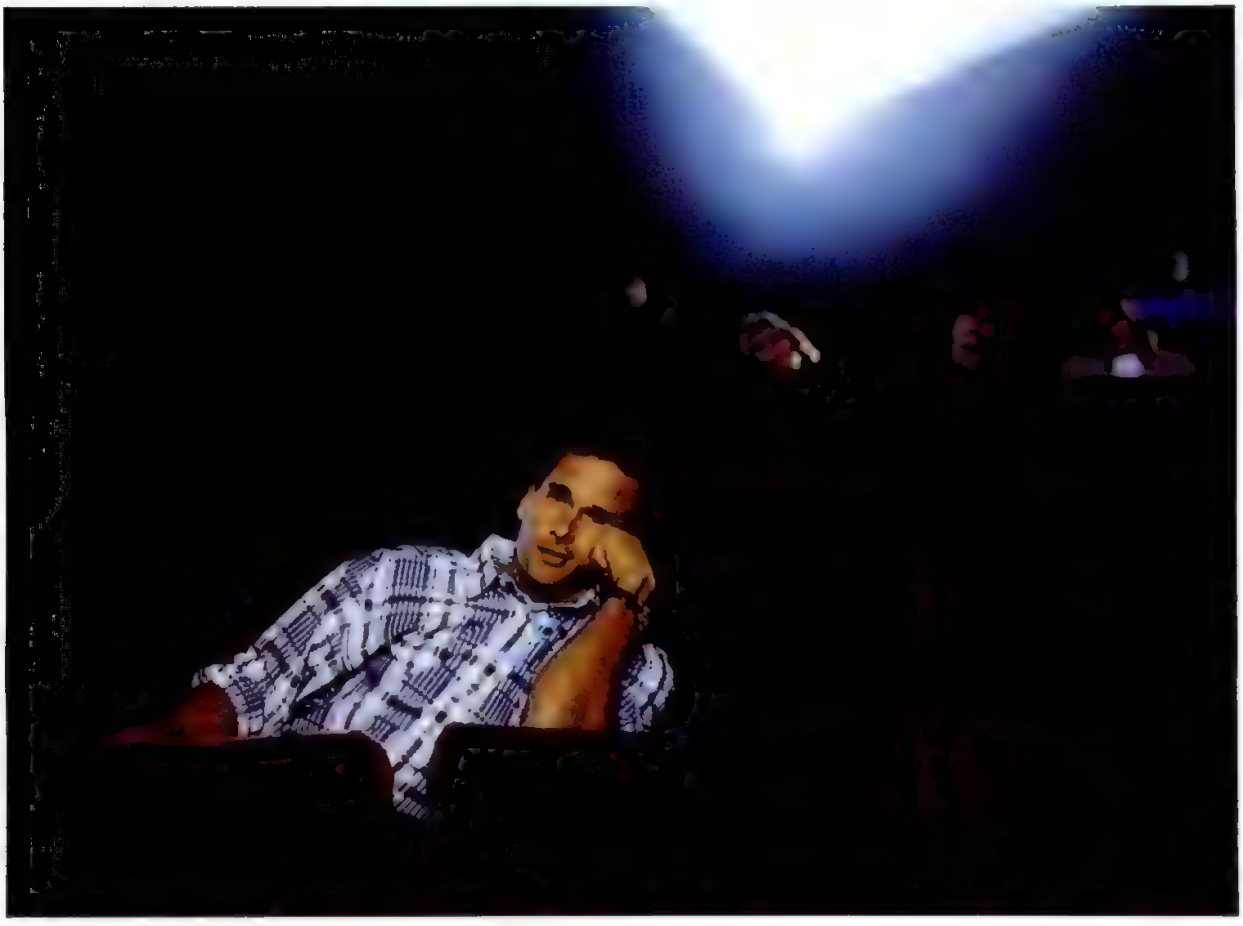

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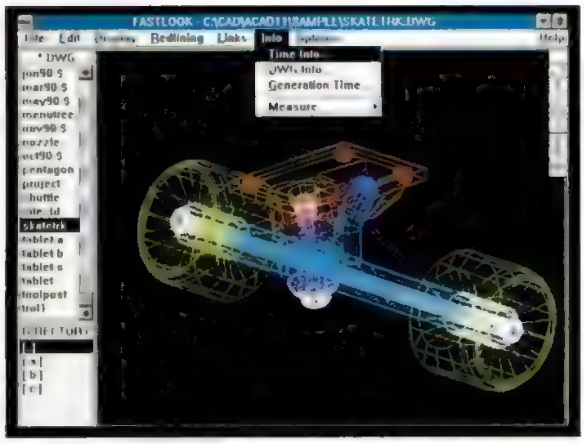


***FastLook Plus* makes solid use of the Windows interface but suffers from Windows' slow speed.**

Windows Clipboard, for example). But the package suffers from the curse of Windows' slowness, so that ultimately *FastLook Plus* displays drawings no faster than *AutoCAD* itself. Speed problems aside, this program may be the right choice for those working in a Windows environment.

FastLook Plus, Version 5.0
Kamel Software Inc., 1215 Gallant Fox Way, Chuluota, FL 32766; 407-366-1172.
List Price: $295.
Requires: For DOS version: 640K RAM, 1.5MB hard disk space, DOS 3.0 or later. For Windows version: 1MB RAM, 800K hard disk space, Windows 3.0. Math coprocessor and pointing device recommended.
CIRCLE 518 ON READER SERVICE CARD

SirlinVIEW Plus

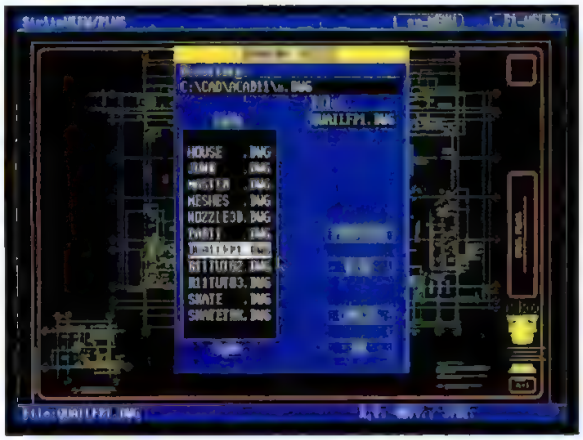
SirlinVIEW Plus ($495) has all the bells and whistles you could ask for in a drawing manager, but none of the power and speed to make them worth setting off. This package has some innovative features, such as the ability to add Post-it–style notes to displayed drawings, or to query objects in a drawing against records in a database. But Sirlin Computer Corp. seems to have forgotten that the program's main purpose is to display drawings quickly.

The main menu offers seven functions, the first being to load a drawing; here you immediately see some of the program's limitations. The drawing selection screen lists only the files in the current subdirectory (matching a user-definable file mask). If you want to view files in a different subdirectory, you must type that subdirectory name into the directory field—an annoyance.

SirlinVIEW Plus does not do a complete job of displaying drawing files. The program can be used to view .DWG, .DXF, and HPGL files, but it does not support the full complement of entities in *AutoCAD*, Release 11. It displays every drawing in plan view; there is no way to view 3-D objects. It also cannot handle meshes, variable-width polylines, or solids created using *AutoCAD*'s *AME* solid modeler. Worst of all, drawings last saved in paper space seem to lock the program completely.

To its credit, *SirlinVIEW Plus* does offer the ability to link drawings together in a hypertext-like fashion, but it requires that you manually create a separate ASCII file containing actual drawing coordinates and filenames to create these links. This is hardly an intuitive method.

A TSR version called *SirlinVIEW Pop*



***SirlinVIEW Plus*'s file list displays only drawing files in the current directory. To change directories, users are forced to type in the new subdirectory name.**

AUTOCAD DRAWING VIEWER SUMMARY OF FEATURES

Products listed in alphabetical order

■—Yes ⌟—No

List price	
AUTOCAD COMPATIBILITIES	
Supports .DWG versions:	
Version 2.1	■
Version 2.5 through Release 11	■
Converts to different versions:	
Version 2.1	■
Version 2.5	■
Version 2.6	■
Release 9	■
Release 10	■
Release 11	■
ENTITY TYPES DISPLAYED	
Shapes	■
Polylines:	
With width	■
With variable width	■
Polyline meshes	■
Curved or spline-fit polylines	■
Dashed or dotted wide polylines	■
Line types properly centered	■
Different line type scales	■
Entities with thickness	■
Filled solids	■
Rat meshes	■
Hatch patterns	■
AME entities	■
Arrayed inserts	■
Nested blocks	■
FILE FORMATS DISPLAYED	
.DWG	■
.DXB	■
.DXF	■
HPGL	■
IGES	■
.PCX	■
.SLD	■
TIFF	■
ZOOMING AND PANNING	
Zoom window	■
Zoom to extents	■
Zoom by factor	■
Pan	■
OTHER DISPLAY FEATURES	
Drawing information	■
Three-dimensional entities	■
Select a 3-D view (as with VPoint)	■
True SHX fonts	■
Paper space/model space toggle	■
Reference files	■
Named views	■
Maximum number of simultaneous drawings	1
Measure distances	■
Rotate drawing	■
Display version of drawing last saved	■
FILE MANAGEMENT	
Copy	■
Rename	■
Delete	■
Tag groups of files	■
View file attributes	■
Change file attributes	■
Specify file masks	■

N/A—Not applicable This product views only HPGL files

AUTOCAD UTILITIES

AutoManager Professional	AutoSight Access	AutoView Plus	AutoVue	Drawing Librarian Professional	FastLook Plus	SirlinVIEW Plus	Slick! 386	SoftWest Quick-See	ViewPort Plus
$495	$299	$195	$250	$500	$295	$495	$450	$199	$495
■	□	□	■	□	□	■	□	□	N/A
■	■	■	■	■	■	■	■	■	N/A
□	□	□	□	□	□	□	□	□	N/A
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($125) is also available, but it offers no additional display features. In *SirlinVIEW Plus*, the database links, hypertext, and notes features are innovative, but the many rough edges need to be smoothed out before this package can be considered a contender.

***SirlinVIEW Plus*, Version 1.2**
Sirlin Computer Corp., 25 Orchard View Dr., #14, Londonderry, NH 03053; 603-437-0727.
List Price: Single user, $495; five users, $1,175; each additional user, $200.
Requires: 512K RAM, 2MB hard disk space, DOS 3.0 or later. Pointing device and math coprocessor recommended.
CIRCLE 520 ON READER SERVICE CARD

Slick! 386

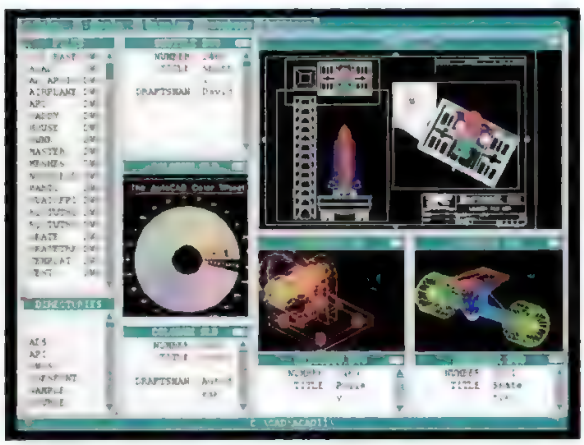
Slick! 386 ($450), from CAD Systems Unlimited, is the latest version of a drawing-viewing package with a long history. Before anyone had succeeded in deciphering *AutoCAD*'s .DWG file format, *Slick! 386* was sold as a slide viewer that ran entirely within *AutoCAD*. Since then, the program has been constantly enhanced and, as its name implies, updated to run as a real-mode 386 application, as well as in expanded mode or with a virtual memory manager. All the work has paid off. *Slick! 386* doesn't try to be all things to all people. What it does, quite simply, is allow you to view *AutoCAD* drawings quickly.

The opening screen presents a simple layout. The top bar contains pull-down menus; to the left, a list shows files in the current subdirectory matching a single user-definable mask. Below is a directory window. The main portion of the screen is the graphics window, where drawing or slide files are displayed. You can divide this screen into as many as four active windows and, if you've enabled *Slick! 386*'s database feature, see the associated database window below each of the graphics windows.

Slick! 386 is teamed with a powerful *dBASE*-compatible database that lets you attach important information such as a project name, a drawing description, and the name of the draftsperson to the drawing. Once you've entered database information, it is relatively easy to sort the data and search for specific files, using up to ten conditions per query to hasten the search.

Virtually all *AutoCAD* drawing entities display quickly and accurately. *Slick! 386* is adept at displaying reference files and easily toggles between paper space and model space. The program also comes with a separate viewer built as an *AutoCAD* ADS application. This viewer lets you view one *AutoCAD* drawing while you're editing another from within *AutoCAD*. The program's redlining feature is also powerful and even offers its own object snap commands, but unfortunately you must remember to save the redlined data manually.

This program cannot display a myriad of file types, but it does display drawings quickly. If you're looking for an *AutoCAD* drawing viewer/file manager that recognizes that some information is best tracked with an associated database, it would be difficult to find one much better than *Slick! 386*.



***Slick! 386* allows each drawing file to have an associated record within the database, and you can easily add fields and build complex search criteria.**

Slick! 386
CAD Systems Unlimited Inc., 5201 Great America Pkwy., #443, Santa Clara, CA 95054; 408-562-5762.
List Price: Single user, $450; network version, $1,795.
Requires: 2MB RAM, math coprocessor, DOS 3.1 or later, pointing device.
CIRCLE 521 ON READER SERVICE CARD

SoftWest Quick-See

The Great SoftWestern Company, well known in *AutoCAD* circles as a developer of vertical applications, is trying to reach a broader market with *SoftWest Quick-See*, a $199 drawing viewer. This program provides no file management or database features; it simply lets you view .DWG, .DXF, HPGL, .PIC, and .SLD files. *SoftWest Quick-See* can also convert displayed files into HPGL and .PIC formats.

Users first select the type of file, then *SoftWest Quick-See* presents a list of matching files, sorted alphabetically. Pressing Return loads the highlighted file.

The program displays up to nine files, each in its own window. You need to clear windows manually to make room for additional drawings, but *Quick-See* is easily controlled using either a mouse or the keyboard. Digitizers are supported only if they properly emulate a Microsoft mouse.

There are 16 3-D push buttons arrayed down the left side of the screen to let you load files, control the display of individual layers, change the 3-D viewing orientation of the current drawing, print the drawing, zoom, pan, clear the viewport, and toggle such features as solid fill.

Quick-See works with *AutoCAD*, Versions 2.5 and later, but it has trouble displaying some polyline entities. It does not support paper space, and attempting to

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CIRCLE 217 ON READER SERVICE CARD

view a drawing containing external references causes the program to crash. The program seems slower than others when it first loads a drawing, but successive pans and zooms are quite fast.

SoftWest Quick-See doesn't pretend to be a drawing management program, but even as a drawing viewer, it needs some work. Problems handling *AutoCAD* 11 features such as reference files and paper space make this a program to avoid, at least for now.

SoftWest Quick-See, Version 4.0f
The Great SoftWestern Company Inc., 919 S. Carroll Blvd., #103, Denton, TX 76201; 800-231-6880, 817-383-4434.
List Price: $199.
Requires: 640K RAM, math coprocessor, DOS 3.1 or later. Pointing device recommended.
CIRCLE **519** ON READER SERVICE CARD

ViewPort Plus

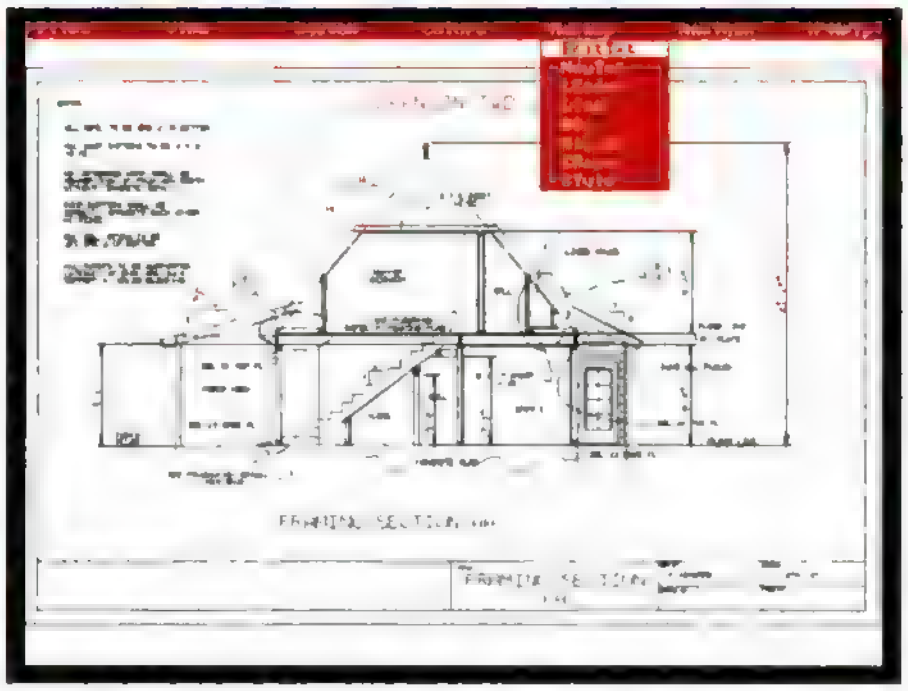
Cadman Corp.'s *ViewPort Plus* ($495) is not your standard *AutoCAD* file viewer. Rather than .DWG files, *ViewPort Plus* displays a proprietary format that it quickly generates from HPGL plot files. Like many unusual approaches, this one has both advantages and disadvantages.

On the positive side, files display incredibly fast, and since virtually every CAD package supports Hewlett-Packard plotters, you can use *ViewPort Plus* to manage files created by many different programs, not just *AutoCAD*. And since the program doesn't work with .DWG files, you don't need to worry about external reference files and paper space.

The main drawback of this program is that you must maintain two sets of files: the original CAD drawings and the *ViewPort Plus* versions. *ViewPort Plus* is also the only program in this roundup that is copy protected.

ViewPort Plus is relatively easy to use, and its redlining capabilities are particularly powerful. You can save notations with the original *ViewPort Plus* file or as a separate "mark-up" file. You can overlay multiple drawings (which is particularly useful for checking revisions) and measure distances and angles within drawings, though not very accurately.

Although probably not the viewer of choice for offices that use only *AutoCAD*, *ViewPort Plus* is quick and easy to use. If you use several different CAD packages,



Although it always uses its own file format, which it generates from HPGL plot files of your drawings, *ViewPort Plus* has robust redlining capabilities and displays drawings quickly.

this is an excellent choice. Otherwise, its neutral file format and copy protection should be your clues to look elsewhere.

ViewPort Plus, Version D3.06
Cadman Corp., 19700 S. Vermont, #100, Torrance, CA 90502; 310-515-1289.
List Price: $495; with redlining and translation features, $795; with *ViewPort Plus Toolkit* (for customizing the program), $1,495.
Requires: 512K RAM, DOS 3.0 or later. Copy protected.
CIRCLE **522** ON READER SERVICE CARD

TEXT EDITORS

Editing AutoCAD Text: More than Meets the Eye

by David Byrnes

While *AutoCAD* is a powerful and flexible graphics tool, its text functions have always tried users' patience. AutoDesk has advanced a bit, anyway; with the advent of Release 11, users no longer have to reenter an entire line of text in order to make even the smallest correction (as they did in all previous versions). But *AutoCAD* still falls far short of most users' text-handling needs, both because not everyone has upgraded to Release 11 and because most users need to be able to do more than correct typos. That's where third-party text editors come in.

Actually, an *AutoCAD* text editor should streamline text operations in two distinct areas. First, it should expedite the creation and manipulation of drawing text and attributes (textual information in the drawing file that makes up an information database), and it should function as a tool for customizing *AutoCAD* itself. Desirable features for editing text entities (drawing text and attributes) include the ability to select text from the drawing and automatically load it into the editor. Once the text is loaded, standard word processing features such as cut-and-paste, word wrap, and search-and-replace should be on call.

Ideally, an *AutoCAD* editor should run seamlessly inside *AutoCAD*, as if it were simply another *AutoCAD* command. The majority of the editors we reviewed, however, cannot do this. To use these packages, the user must shell out to DOS for editorial functions. In this respect, especially for ASCII editing, they offer little benefit over mainstream ASCII editors. Only applications that run under *AutoCAD* 11's new programming environment, the Autodesk Development System (ADS), run without this time-consuming shell.

THE ADS ADVANTAGE

ADS applications—including horizontal applications such as text editors—do in effect run from within *AutoCAD* and are typically very easy to load and run. In this article we review the two available ADS editors, *CADMagic* and *Ketiv Editor*, and we are happy to report that they work as you might hope, placing you in the editor almost the instant you select the text to edit. ADS is clearly the wave of the future for text editors, if not for all *AutoCAD* add-ons.

Unfortunately, *AutoCAD* users who have not yet upgraded to Release 11 will have to pass over the ADS programs for one of the others. Here the choices are not quite so clear-cut; a final selection will probably hinge on which package has the features you deem most useful. Users of *AutoCAD*, Release 11, can of course choose among the non-ADS programs as well.

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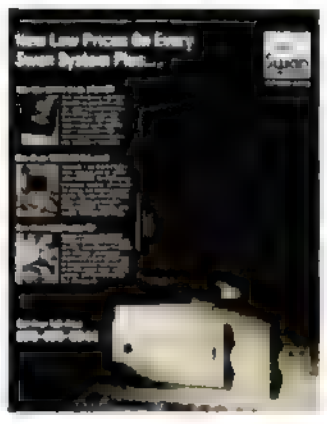

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AUTOCAD UTILITIES: TEXT EDITORS

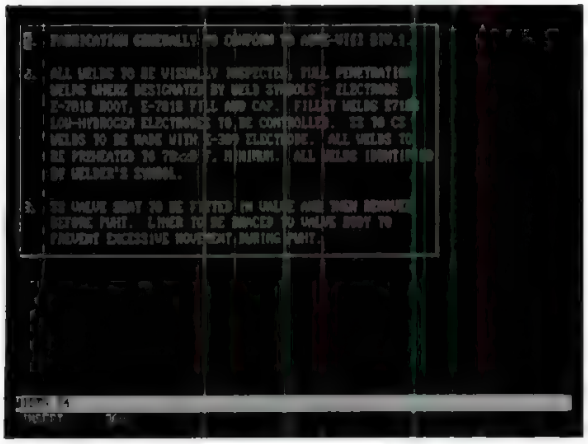
AutoSE

At $150, Applied Software Technology's *AutoSE* is one of the most expensive editors available; unfortunately, it is also one of the most limited. In addition, it is the most difficult to use of the programs reviewed here.

AutoSE bills itself as offering "three formats at one affordable price." This refers to its ability to edit text, columns, and schedules. Some of these features do work as advertised; for instance, inserting new text into a paragraph you have pulled off the drawing does indeed reformat the paragraph when it is reinserted into the drawing. But many of the promised features are difficult to use or impossible to find.

An example: The program is supposed to be able to import a comma-delimited text file and place it as a table complete with grid lines on the drawing, but the manual fails to document this procedure. The manual is poorly organized in general: There is no index, the same section numbers are used in different parts of the document, and you are referred to section numbers that don't exist.

The editor has an irritating habit of losing the first vector in a text entry. You need to regenerate the screen to bring the full character back. The program also shells out a second time after it has placed the text on the drawing, and it insists on turning the BLIPMODE variable back on after you've turned it off.

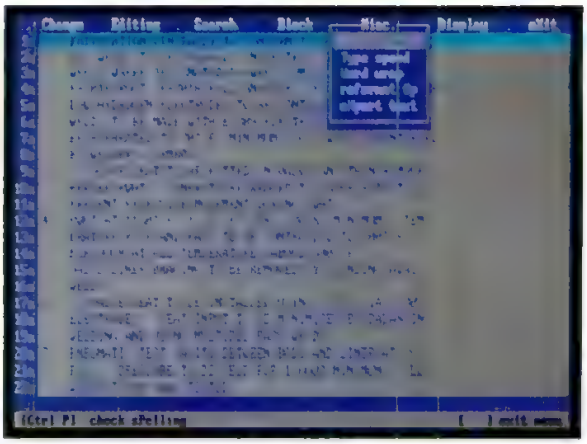


***AutoSE*'s editor has no menu interface; therefore, users must type commands (such as WIDTH 24) at its command line.**

Columnar formatting is one of *AutoSE*'s strengths. You can set the column width before you start entering text simply by picking points at the left and right margins. You can indicate a standard title block with a lined-off area for notes and then start entering your notes without worrying where the margins will fall; the editor will automatically wrap words at the appropriate location.

If more of its features worked as advertised, *AutoSE* would be worth a look. As the program stands, though, it has little to recommend it.

AutoSE, Version 2.6
Applied Software Technology Inc., 1908 Cliff Valley Way NE, Atlanta, GA 30329; 800-899-2784, 404-633-8660.
List Price: $150.
Requires: *AutoCAD*, Version 9 or later.
CIRCLE 523 ON READER SERVICE CARD



All of *Cadet*'s editing functions can be accessed via pull-down menus—but only from the keyboard. There is no mouse support.

Cadet

If you're looking for a utility to ease text creation and manipulation on your drawings and you don't mind that it is not ADS-based, *Cadet* ($49.95) is an excellent value. This program, from Wasco Technical Software, is distributed both as commercial software and as shareware. You can order it directly or download it from Autodesk's ACAD Forum on CompuServe.

Cadet consists of a compiled executable routine that loads and unloads via AutoLISP. *Cadet* works only with drawing text; you can't use it to write AutoLISP programs or edit menus. It also lacks *AutoCAD* 11's new text justifications. And unlike the ADS editors, *Cadet* makes you wait while it shells out to DOS to reach the editor. Once you are in the editor, however, it is a delight to use. *Cadet* includes standard features such as cut-and-paste and search-and-replace. It also includes word wrap, which is missing from most of the other editors but is essential if you want to compose a set of general notes. The editor has a limit of 99 lines, though, so you may have to create large blocks of text in stages.

The spell-checker is unique among the text editors in this review. At 112,000 words, it's surprisingly quick; it pops up a list of suggested correct spellings much faster than the spell-checkers in many word processors. Another unique feature in this program is the table editor, which can place a perfectly formatted table on your drawing. To use this editor, you simply call up the routine, tell it how many columns and rows you want (the product of the two cannot exceed 99), specify text height and line spacing, and show it where to locate the columns. You must use a fixed-spaced font, such as *AutoCAD*'s MONOTXT, however, for the table to work properly.

Cadet's spell-checker and table editor make up for the fact that the package can only handle drawing text. If you aren't using *AutoCAD* for a 386 machine, or if you are and can put up with shelling back and forth to use the editor, this program is hard to beat.

Cadet, Version 3.0
Wasco Technical Software, 1211 Grand Junction Dr., Katy, TX 77450; 713-392-1359
List Price: $49.95.
Requires: *AutoCAD*, Release 9 or later.
CIRCLE 524 ON READER SERVICE CARD

CADMagic

CADMagic is actually a comprehensive ADS-based toolkit for *AutoCAD*, Release 11. It provides not only slick text-handling routines but an auto-save feature, a drawing revision tracker, and a file-management facility that helps you find and then automatically load files—and that's just a few of the seven programs—for the astounding price of $50.

***CADMagic*'s dialog boxes, such as this one for Attribute Search and Replace, pop up over the drawing on a VGA or Soft Engine display.**

CADMagic actually supplies two editors: Scribe, the text editor, and Merlin, the parametric editor. Select Scribe from the *CADMagic* menu and you'll be prompted to select a group of text. The full-screen editor appears almost instantaneously, with the text loaded and ready for editing. If you don't select any text, a blank editing screen appears. These options are for working with drawing text. A command line function lets you create and edit text files.

Merlin works on three types of items: blocks, text, and entities. The first lets you search and replace attribute data or complete blocks, while the second searches and replaces text strings and changes layers, colors, styles, or justification. *CADMagic* is as current as the latest version of *AutoCAD:* It includes all of the new text justifications found in Release 11 and even lets you transfer or strip extended entity data.

The program's support is outstanding. In addition to comprehensive, context-sensitive on-line help, the handsome printed documentation is thorough and well laid out, and there is even an 800 number for free, unlimited tech support.

This is a polished collection of tools at a remarkable price. All seven utilities work as you'd expect. One or two of them would be well worth the price; all seven for $50 is an unbeatable value.

CADMagic, Version 1.01
Haestad Methods Inc., 37 Brookside Rd., Waterbury, CT 06708; 800-727-6555, 203-755-1666.
List Price: $50.
Requires: *AutoCAD*, Release 11.
CIRCLE 525 ON READER SERVICE CARD

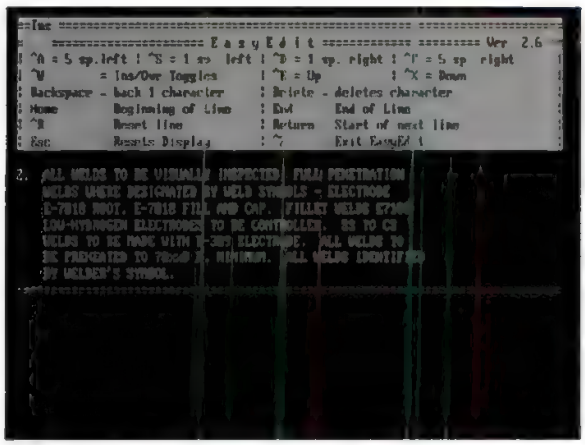
Easy Edit Plus for Release 11

ADC Computer Services' *Easy Edit Plus for Release 11* ($95) doesn't live up to its billing. Editing is not particularly easy with this program, and there's little in the

AUTOCAD TEXT EDITORS: SUMMARY OF FEATURES

Products listed in alphabetical order

■—Yes ❑—No	AutoSE	Cadet	CADMagic	EasyEdit Plus for Release 11	E-Z Word	Ketiv Editor
List price	$150.00	$49.95	$50.00	$95.00	$79.95	$150.00
LANGUAGE						
AutoLISP	■	■	❑	■	■	❑
ADS	❑	❑	■	❑	❑	■
TEXT TYPES EDITED						
Drawing text	■	■	■	■	■	■
Attributes	❑	■	■	■	❑	❑
External text files	❑	❑	■	❑	❑	■
EDITING FEATURES						
Cut-and-paste	■	■	■	■	❑	■
Word wrap	■	■	❑	❑	❑	❑
Search-and-replace	■	■	■	■	❑	■
Spell-checker	❑	■	❑	❑	❑	❑
Boldface text	❑	❑	❑	❑	■	❑
Text in arc	❑	❑	❑	❑	■	❑
Change case	❑	■	❑	❑	■	❑
Change appearance	■	■	■	■	■	■
Explode text strings	❑	❑	❑	❑	■	❑
Break text strings	❑	■	■	■	■	■
Columnar formatting	■	■	❑	❑	❑	❑
OTHER FEATURES						
Auto-save	❑	❑	■	❑	❑	❑
Supplied ACAD.MNU file	❑	❑	❑	❑	■	❑



***Easy Edit Plus for Release 11*'s Help screen is continuously visible whenever you are in the editor.**

way of a "plus." It has fewer features than many of the less expensive programs in this roundup, and many of these features work erratically or not at all.

The program consists of AutoLISP routines that carry out the standard editing functions, but only on existing drawing text. You can't create or edit text files with it. Furthermore, it has the shortest manual and least helpful installation module of any of the programs we reviewed.

Easy Edit Plus does not cope well with zero-height text styles. Adding new lines with a style defined as 2 inches high works, but if you try the same with zero-height text created at 2 inches high, the first line turns into a string of 0s and both lines end up with a 2-degree rotation.

Other annoyances range from the command line echo of the ANSI escape characters to more alarming problems, such as the "Bad argument type" and "AutoCAD rejected function" error messages that appear even after routines have executed properly. The package also insists on turning on the BLIPMODE variable after you've turned it off.

Some functions do work well, however. The program imports and exports text files easily and quickly. In addition, the "Break text" routine locates the broken text properly below the original line, unlike similar routines in other editors. All things considered, however, you can easily find a program that works more predictably for less money.

Easy Edit Plus for Release 11
ADC Computer Services Inc., 14825 E. 42nd St., #220, Independence, MO 64055; 816-373-1100.
List Price: $95.
Requires: *AutoCAD*, Release 9 or later.
CIRCLE **526** ON READER SERVICE CARD

Text and Attribute Editor	Textools	WCEdit
$125.00	$200.00 (U.S.) $250.00 (Canada.)	$100.00
■	■	❑
❑	❑	■
■	■	■
■	■	❑
❑	❑	❑
■	■	■
❑	❑	■
■	■	■
❑	❑	❑
❑	■	❑
❑	❑	❑
■	❑	❑
■	❑	❑
❑	❑	❑
■	■	❑
❑	■	❑
❑	❑	❑
❑	■	❑
❑	■	❑

E-Z Word

E-Z Word ($79.95) is not really a text editor at all. It's a handy utility that acts as an interface between *AutoCAD* and the ASCII editor of your choice, with a few extra features thrown in. While it does indeed make editing *AutoCAD* text with another editor quite easy, if you don't have a separate text editor, *E-Z Word* won't do you a bit of good.

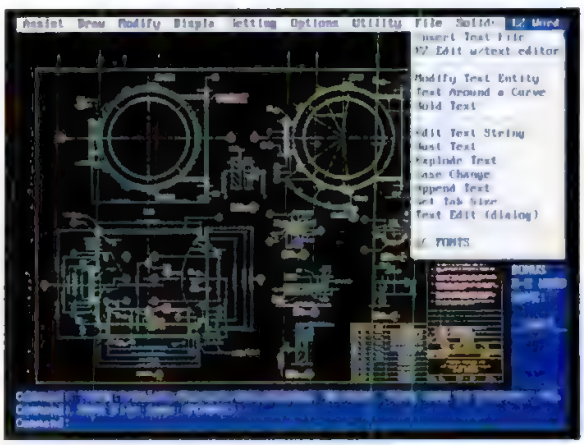
This AutoLISP program installs smoothly, and the documentation provided is first-rate. To get the package up and running, you simply pick *E-Z Word* from the provided pull-down or screen menu and select a block of existing text. The program then shells out and starts your editor with the selected text already loaded. Edit your text, save, and quit, and you are returned to your drawing; the original text disappears and the new version appears in its place.

E-Z Word includes a number of additional useful features. It lets you place text in an arc (although as individual letters, not as strings), change it to boldface by making slightly offset multiple copies, or break a line of text into two (although you can't automatically place the broken section as a new line below the preceding one).

You can change the case of a group of text, explode text strings into individual letters, globally search and replace text, and modify a text string's height, width, style, obliquing angle, or rotation. Finally, *E-Z Word* adds six fonts to *AutoCAD*'s set: two hand-lettered, three Helvetica, and a monospaced Simplex.

E-Z Word is a well-designed text utility that eases the editing process and adds some attractive extra features. If you already have an ASCII editor you are comfortable with, it's a good buy.

***E-Z Word*, Version 11.1**
LandCADD International, 7519 E. Highway 86, Franktown, CO 80116; 303-688-8160.
List Price: $79.95.
Requires: *AutoCAD*, Release 10 or 11; separate text editor.
CIRCLE **527** ON READER SERVICE CARD



***E-Z Word* adds its own pull-down and bottom-of-screen menus to *AutoCAD*'s menus.**

Ketiv Editor

Ketiv Editor ($150) is one of the easiest to use of the current batch of text editors. It is an ADS application, so it's faster than most, and it handles drawing text and programming tasks with equal aplomb. As an ADS application, of course, it works only with *AutoCAD*, Release 11.

The editing screen is well laid out, with the major file and editing functions on pull-down menus. The editor loads the text you were working on, even putting the cursor where it was when you closed the file—a nice touch. This is especially handy for programming and debugging.

The editor carries out search-and-replace, copy, and cut-and-paste operations on blocks of text. There is even an "Oops" function that restores a deleted block.

The program does have some shortcomings: It works on text entities only; you can't use it to edit attributes. It won't automatically sort a group of text by *y* value; if you select a paragraph with a window, it comes into the editor with the lines in reverse order. It is simply unacceptable to have to select 30 or 40 lines of text one after the other in order to get them into the editor in the correct order.

On balance, though, *Ketiv Editor* is a polished and powerful program that is as comfortable with creating or editing drawing text as it is with writing programs.

***Ketiv Editor*, Version 1.00**
Ketiv Technologies Inc., 6601 NE 78th Ct., A-8, Portland, OR 97218; 800-458-0690, 503-252-3230.
List Price: $150.
Requires: *AutoCAD*, Release 11; authorization code linked to *AutoCAD* serial number.
CIRCLE 528 ON READER SERVICE CARD

***Ketiv Editor*'s functions can be called with Alt-letter combinations or selected from pull-down menus.**

Text and Attribute Editor

The whole reason to buy a text editor is to make up for *AutoCAD*'s text-handling deficiencies. Unfortunately, *Text and Attribute Editor* ($125) is in some instances less efficient at handling text than *AutoCAD* itself. It is also one of the slowest, most limited programs in our review.

To start editing, you enter EDT from the command line, select text, then wait while the package executes a shell and loads the full-screen editor. *Text and Attribute Editor* does integrate *AutoCAD*-specific text functions (such as setting text style, height, or width) and word processor–like text handling (such as changing case or cutting-and-pasting).

Select attributed blocks for editing and the program shells back out to the familiar editing screen. You can select more than one block for editing, but the program shells back into *AutoCAD* when you finish one and then back out again before it loads the next block. Even *AutoCAD*'s own DDATTE command is superior, since you don't have to shell out of the drawing to use it.

Until *Text and Attribute Editor* can improve on *AutoCAD*'s text handling, there is no reason to spend your money on this package.

***Text and Attribute Editor*, Version 2.22**
MarComp, 13 Lauriann #100, Parkton, MD 21120; 301-343-2743.
List Price: $125.
Requires: *AutoCAD*, Release 9 or later.
CIRCLE 529 ON READER SERVICE CARD

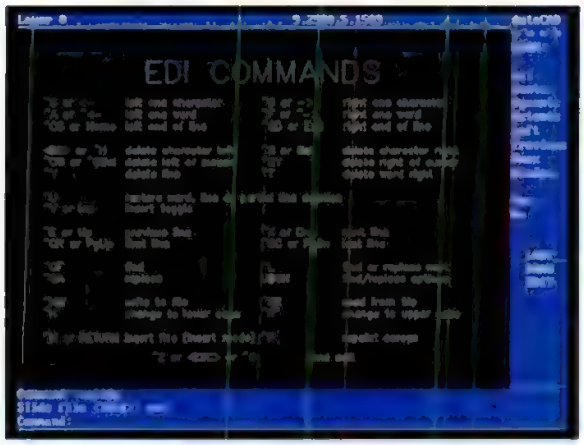
***Text and Attribute Editor* displays the current text style along with basic information on the cursor location and text-entry mode.**

Textools

While on the surface Nexsys Consulting's *Textools* ($200) seems like a complete *AutoCAD* text toolkit, it has some important limitations. But on the plus side, in addition to an editor, this package includes such unique utilities as a bearing/distance line-labeling feature, a Label function that draws plain or shadowed boxes around text, a shape decompiler, an auto-save feature, and a function that converts *AutoCAD* .SLD files to .DXF format. This last function lets Release 10 emulate Release 11's "multiple viewpoint while plotting" feature. Another plus is a set of font files (both .SHP and .SHX) that add superscript and subscript capability to standard *AutoCAD* fonts, allowing the creation of real fractions.

The main component of the package is EDI, the AutoLISP-written text editor. Unlike any of the other editors in this review, EDI lets you edit actual drawing text; you don't need to select a group and then load it into the editor. (*WordStar* aficionados will love it, since it mimics that program's keystrokes.) However, its unique approach to text editing is also the basis of the program's limitations. It will edit only existing drawing text; you can't use EDI for programming or menu customization or to create new text.

Textools' ability to edit *AutoCAD* text entities in real time proves to be a trade-off, counterbalanced by its inability to edit text files. For many users, however, the package's various other utilities, especially the shape decompiler and the .SLD-to-.DXF converter, may well make



EDI, *Textools'* text editor, uses *WordStar*-like Ctrl-key combinations.

it worth its hefty price tag.

***Textools*, Version 4.2**
Nexsys Consulting Inc., 44 Douglas Dr., Ayr, Ontario, Canada N0B 1E0; 519-632-8243.
List Price: $200 (U.S.), $250 (Canada).
Requires: *AutoCAD*, Release 10 or later; DOS ANSI.SYS device driver.
CIRCLE 530 ON READER SERVICE CARD

WCEdit

WCEdit ($100) is an editor for programmers rather than drafters. While the other packages in this roundup are primarily utilities for modifying text in a drawing, *WCEdit* is designed primarily for writing AutoLISP routines and editing menus. Don't misunderstand. The program is highly customizable; you can program it to work with drawing text as well as to emulate any text editor or word processor you may already be familiar with. But this flexibility comes at a price: *WCEdit* has a steeper learning curve than any of the other programs, and it requires a sound knowledge of AutoLISP.

The language used to program *WCEdit* is AutoLISP itself, yet it is an ADS application requiring *AutoCAD*, Release 11. Once loaded, the program is blazingly fast. Enter WC from the command line and you're in the editor instantly, with the file you last worked on loaded and the cursor where you left it. *WCEdit* will maintain your place even if you end one drawing and start another.

The program is designed to edit multiple text files simultaneously; it can hold up to 50 files in memory and lets you cycle through them, cutting and pasting as you go. It will help you in debugging by automatically running your AutoLISP program when you finish editing it. It even checks your LISP routines for syntax errors before reloading them.

The documentation is regrettably thin for a program of this complexity. If you are interested in using AutoLISP to tailor *AutoCAD* to your needs—and that's where real *AutoCAD* productivity begins—*WCEdit* should prove invaluable. If you are looking for a simple text editor, however, look elsewhere. ■

***WCEdit*, Version 1.02**
Walter M. Craig, 661 Elk Lake Dr., Lexington, KY 40517; 606-268-8908.
List Price: $100.
Requires: *AutoCAD*, Release 11.
CIRCLE 531 ON READER SERVICE CARD

David Byrnes is a consultant in architectural preservation who has coauthored three books on AutoCAD. *David Cohn is a senior editor at* CADalyst *magazine and the author of* Complete AutoCAD.

***WCEdit*'s text editor screen displays from one file up to 50 that the program can hold in memory at a time.**

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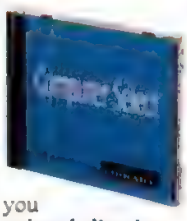

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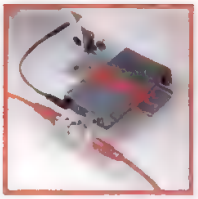

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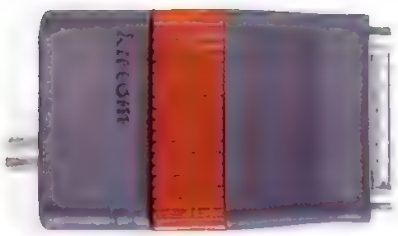

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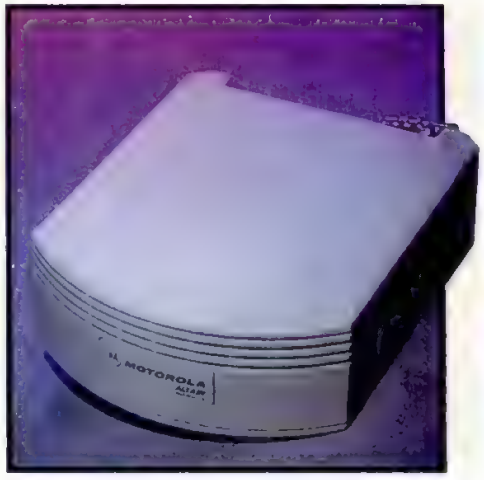
CIRCLE 211 ON READER SERVICE CARD

PORTABLE, AFFORDABLE, SECURE:

WIRELESS LANs



Cable ties networks together, but it can also tie them down when you need to move equipment. PC Magazine LAN Labs evaluates three wireless products from BICC Communications, Motorola, and NCR Corp. that can replace some or all of your cabling.

Network managers know the experience all too well: cables packed into conduits with no room for the thought of another cable. Old buildings, too, pose difficult barriers to wiring a LAN. Even many structures completed as recently as 1980 were designed only for telephone and electrical service, not computer networks. And newer buildings with twisted-pair wiring for the phone and LANs may have incorrectly run or damaged stretches of cable.

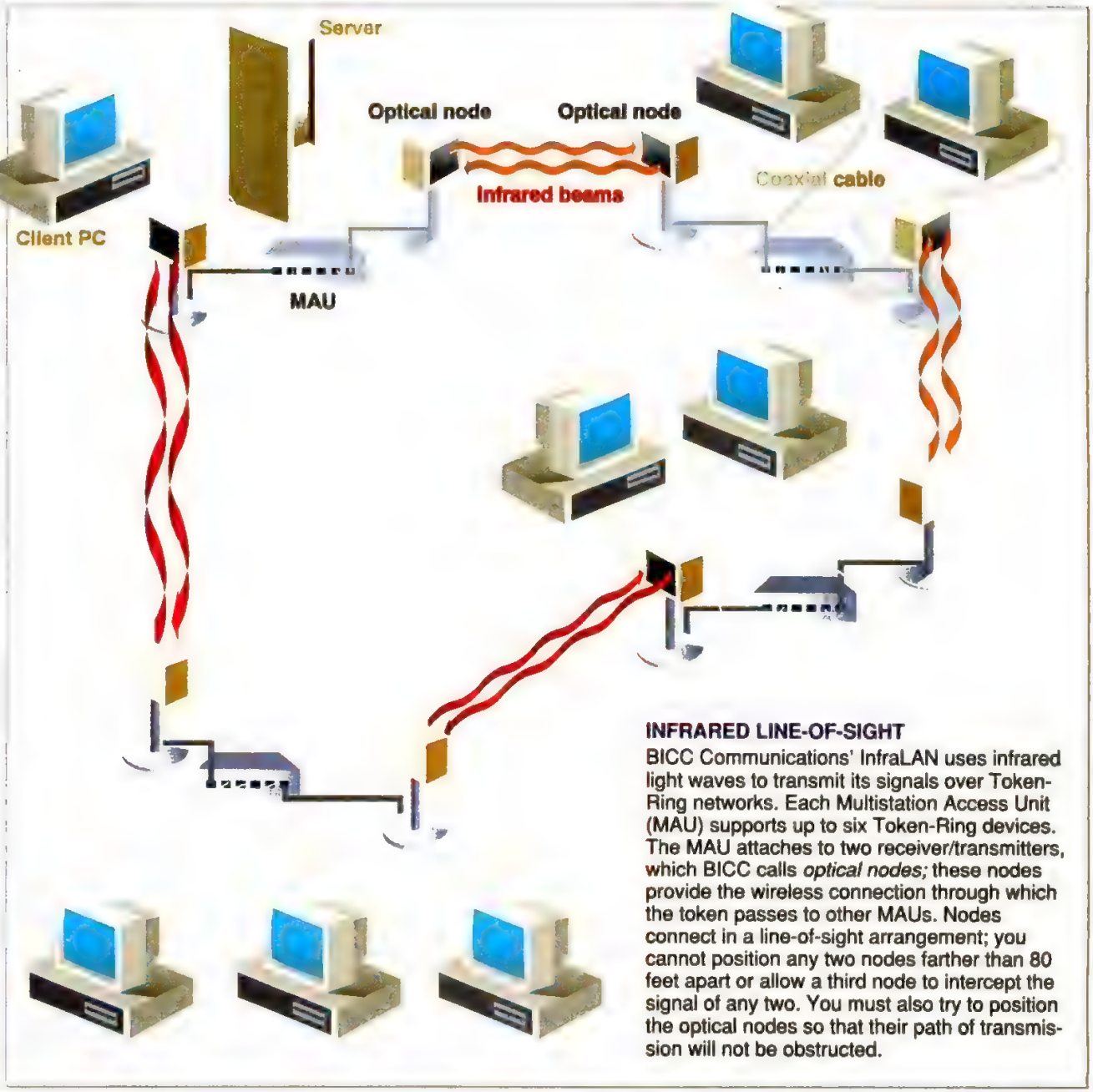
Under the best of circumstances, cabling involves extensive planning. And once you finally drop the first wire, in a

By Gary Berline and Ed Perratore

PHOTOGRAPHY: THOM O'CONNOR

THREE WIRELESS TOPOLOGIES: FACTORING IN THE OFFICE LAYOUT

None of these wireless LAN vendors can be called copycats, for the three products reviewed here feature radically different topologies. Although one of the biggest advantages of wireless networks is increased flexibility, you will still need to make trade-offs among the maximum transmission distance, the number of devices, and the positioning of network nodes. Considering the layout of your own office will help you decide which wireless network best fits your needs.

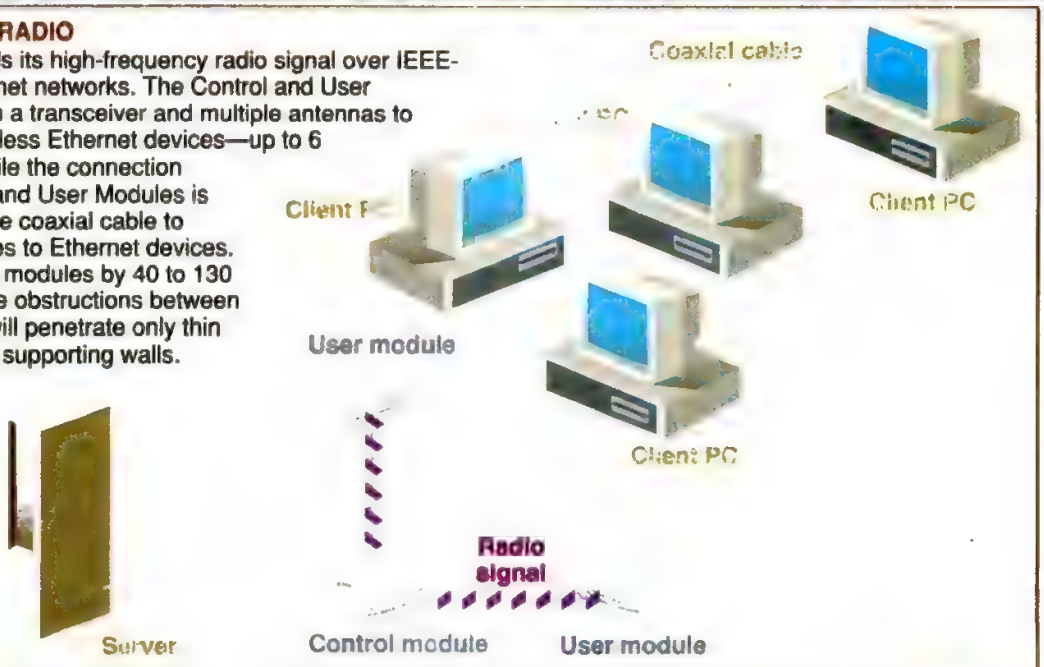


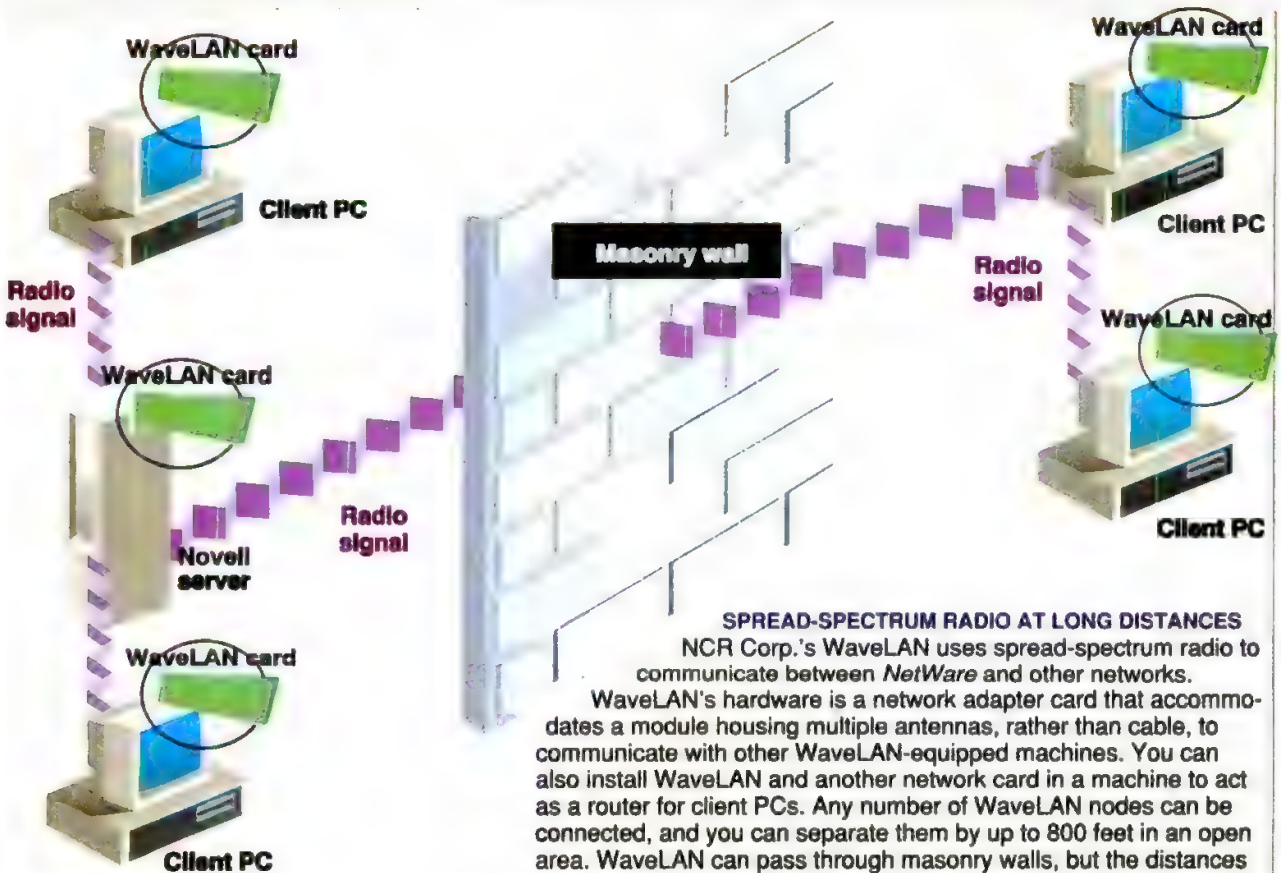
INFRARED LINE-OF-SIGHT

BICC Communications' InfraLAN uses infrared light waves to transmit its signals over Token-Ring networks. Each Multistation Access Unit (MAU) supports up to six Token-Ring devices. The MAU attaches to two receiver/transmitters, which BICC calls *optical nodes;* these nodes provide the wireless connection through which the token passes to other MAUs. Nodes connect in a line-of-sight arrangement; you cannot position any two nodes farther than 80 feet apart or allow a third node to intercept the signal of any two. You must also try to position the optical nodes so that their path of transmission will not be obstructed.

HIGH-FREQUENCY RADIO

Motorola's Altair sends its high-frequency radio signal over IEEE-standard 802.3 Ethernet networks. The Control and User Modules each contain a transceiver and multiple antennas to connect up to 32 wireless Ethernet devices—up to 6 per User Module. While the connection between the Control and User Modules is wireless, you must use coaxial cable to connect these modules to Ethernet devices. You can separate the modules by 40 to 130 feet, depending on the obstructions between them, but the signal will penetrate only thin walls or masonry, not supporting walls.





SPREAD-SPECTRUM RADIO AT LONG DISTANCES

NCR Corp.'s WaveLAN uses spread-spectrum radio to communicate between *NetWare* and other networks. WaveLAN's hardware is a network adapter card that accommodates a module housing multiple antennas, rather than cable, to communicate with other WaveLAN-equipped machines. You can also install WaveLAN and another network card in a machine to act as a router for client PCs. Any number of WaveLAN nodes can be connected, and you can separate them by up to 800 feet in an open area. WaveLAN can pass through masonry walls, but the distances are limited to 110 feet in an environment with fully closed offices.

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Versatility *LC Plus – 512Kb* $595

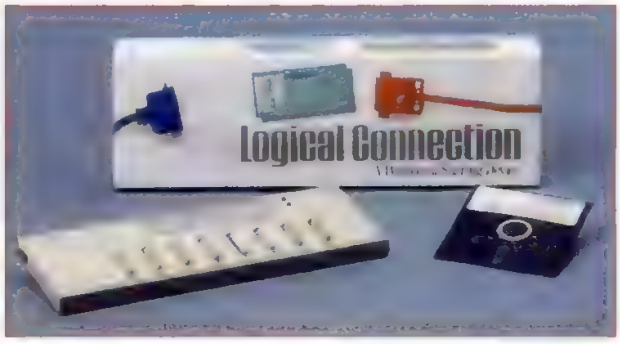
All six ports of the Logical Connection Plus are automatically configured as parallel or serial, and input or output. Installation is a breeze. You just plug in your cables and run the installation software; the LC Plus will do the rest. Besides being very user friendly, the LC Plus processes data at blazing speed for any application. You can share modems and transfer files at 115,200 bps.

6 PCs or Printers/Any Combination

Practicality *LC – 256Kb* $395

The original Logical Connection is still all the printer sharing device that most people need. The LC is ideal for printing of word processing and occasional graphics data. Its eight ports are: four bi-directional serial ports which can be set as input or output, two parallel inputs and two parallel outputs. Six users can share two parallel printers. The serial ports can also share modems.

6 PCs to 2 Printers (Typical)



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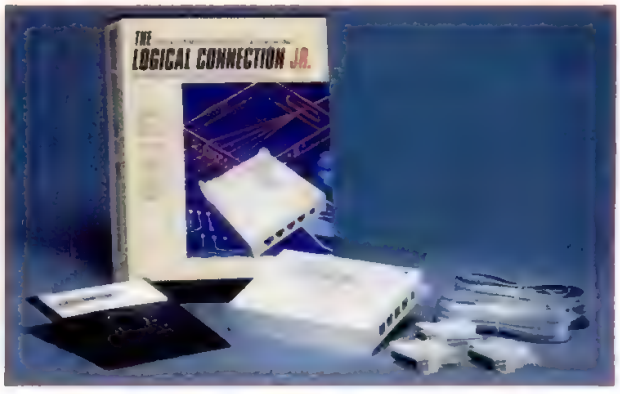
Inexpensive modular cable, even hundreds of feet in length, can be used to serially connect up to four PCs to the Logical Connection Jr. at speeds up to 115,200 bps. Plug your existing parallel printer cable into the LC Jr. and it will automatically convert the data from serial to parallel for fast parallel printing. Multiple users can send data simultaneously since the memory will buffer and queue jobs on a first-in-first-out basis.

4 PCs to 1 Printer



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big city you could be dropping up to $1,000. Moves exact a heavy price as well, and temporary relocations may not last long enough to justify the cost of installing a LAN.

The solution? Wireless systems, which present several options for stretching a wired network's reach, if not entirely eliminating solid media. In this review, we look at three wireless networks: BICC Communications' InfraLAN, for Token-Ring networks; Motorola's Altair, for Ethernet networks; and the Ethernet version of NCR Corp.'s WaveLAN.

You will find these products more appropriate for some situations than others. WaveLAN totally replaces cable, combining a radio transceiver and antenna with a network adapter that plugs into your PC's expansion bus. InfraLAN and Altair aim not to eliminate cable but to extend its reach with a wireless link that connects wired segments. Both attach to your present LAN cards using cable, so neither creates a completely wireless topology.

Altair operates with LANs meeting the IEEE 802.3 specification that standardizes Ethernet networks. Altair communicates via radio waves between a central Control Module and one or more User Modules. InfraLAN exchanges data between its Token-Ring MAUs (Multistation Access Units) using infrared light.

VARIETY OF SOURCES

Wireless LANs draw inspiration from a variety of sources. WaveLAN favors a technique called *spread-spectrum*, while cellular telephone concepts play a large part in Motorola's Altair product. Infrared remote-control units set the stage for InfraLAN years ago.

WaveLAN uses a bandwidth of 902 to 928 megahertz (MHz). This band is one of several that the Federal Communications Commission (FCC) made available for commercial data transmission, and it requires no license, unlike Altair's slice of the spectrum. Although this is a convenient frequency band, the lack of stricter guidelines typically fosters considerable radio traffic.

NCR's product uses a spread-spectrum method known as *direct sequence* to bolster data integrity. Direct sequence protects data from the electromagnetic noise of cordless phones, burglar alarms, and numerous other radio sources that share WaveLAN's spectral niche. The hardware encodes every bit it transmits by sending 11 different bits in series, in patterns representing binary 0s and 1s, at a clip 11 times as fast as the data rate. That way, if the transmission gets garbled, the receiver can guess whether a 1 or a 0 was originally sent—with excellent odds of being right.

WaveLAN's transmissions are capable of traveling from 110 to 800 feet, depending on intervening surfaces. Since these

NO FRILLS, LESS HASSLE: Three Products for File Transfer, Printer Sharing, Electronic Mail

by M. Keith Thompson

For many offices, complete network environments are overkill. Despite all the talk about client/server computing and sharing data across networks, most network users only need to share printers, modems, and other peripherals. We looked at several wireless peripheral-sharing products that provide printer-sharing, e-mail, and file-transfer capabilities. While these systems operate at a fraction of the speed of true LANs and lack virtual-drive capability to access network drives transparently, they typically cost less than wireless networks.

Carrier Current Technologies' CarrierNET offers printer sharing over AC power lines and, with optional *ExcelINET* software, supports e-mail and file-transfer features. Infralink of America markets Infralink, a printer-sharing system based on infrared light. LAWN (for *local area wireless network*), from O'Neill Communications, provides wireless e-mail, file transfers, and peripheral sharing over spread-spectrum radio waves.

These products represent a sampling of the ways that you can use wireless communications without installing a true LAN. In many organizations these systems eliminate the hassle of wiring the office, and for limited networking needs, they all deserve a look.

CARRIERNET: OVER THE POWER LINE

CarrierNET is not a true wireless solution, but it allows you to use existing AC power wires to transfer data, thus freeing you from buying and laying your own cable. A small transceiver box attaches to your computer's serial port and sends data to another transceiver connected to other PCs in the building with the help of bundled software. Using this equipment the computers can share the attached peripherals or send e-mail and files. At $199 per computer or peripheral, CarrierNET is one of the least expensive products available.

Installation is straightforward. You simply plug the CarrierNET transceiver into the power line and into your COM1 or COM2 port and run the menu-driven software to name each computer on the network. Files and print jobs are then sent to the appropriate computer and handled as if the request had come from the same computer. You can have up to 255 computers on a CarrierNET system, each with up to 5 peripherals attached.

CarrierNET operates serially at 38.4 kilobits per second and uses a proprietary data-compression scheme to increase throughput rates further. Though only a fraction of true LAN speed, this throughput is acceptable for printing and e-mail. File transfers, however, work well only with occasional use. All devices on the cable must operate serially, not through the parallel port.

CarrierNET works well with modem wiring; it requires the three-wire grounded outlets that sometimes do not exist in older buildings. Because CarrierNET uses low-frequency radio waves (200 KHz), the signal cannot pass through transformers. As a result, all of your devices must be located on the same side of the transformer. In small office complexes, this is not normally a problem, but companies with offices on different floors of tall office buildings could run into some trouble.

The company also offers an add-on hardware device, CarrierNET Plus, which allows the printer to be used

CONTINUES

transmissions can penetrate walls, ceilings, and floors, WaveLAN excels at networking entire departments. The same strength becomes a weakness, however, when you need to confine the signal to prevent it from affecting nearby equipment that may be sensitive to radio interference.

NCR's system sets no upper bound on the number of users, although excessive traffic does effectively place a limit on user activity, as with any LAN. WaveLAN can also extend existing wired Ethernet or Token-Ring networks, but only with a routing bridge such as the $6,495 Intersect Remote Bridge from

NO FRILLS, LESS HASSLE

CONTINUED

without relying on any one person's desktop. With the unit plugged into the printer and the wall, CarrierNET will see the printer as a separate node address.

While not a speed demon, the CarrierNET hardware/software combination provides a simple wireless solution for sharing printers and transferring data over existing AC power lines. Easy installation and convenience make CarrierNET a good choice for printer sharing.

INFRALINK: INFRARED PRINTER SHARING

Infralink uses infrared light in an unusual way to provide reliable wireless communications with printers. At $499 per computer or printer, the product offers a viable wireless solution for your printer-sharing needs.

Unlike most infrared devices on the market, Infralink is not limited to line-of-sight use. As with spread-spectrum radio products, the waves bounce off the ceilings and walls and provide a wide range of coverage, so you can arrange your work area with maximum flexibility. But you are limited to open office environments and distances of up to 23 feet. Infralink works well in offices with modular cubicle furniture. If you prefer to orient the units directly across from one another, you can communicate up to 230 feet.

Infralink lets you connect an unlimited number of PCs to up to eight printers. Each Infralink transceiver connects to your computer and printer through a standard Centronics parallel printer port. Once connected, you print as usual and Infralink operates transparently. Infralink also offers a serial interface adapter.

What you must sacrifice for this broad-reaching capability is speed: Infralink units transfer data at only 40 Kbps, roughly the same rate that LAWN and CarrierNET have. When printing time is not critical, Infralink will do a fine job.

The wedge-shaped Infralink transceiver measures 8 by 5.5 by 1.5 inches (HWD) and includes an LED that displays status information. Each unit comes with an encryption chip; this, along with Infralink's continuous error-checking, ensures secure data communication. Unlike radio waves, infrared light waves are virtually immune to electrical interference; the result is more reliable data transfers.

Infralink provides a simple plug-and-play printer-sharing solution. Although plagued by slow throughput, it gives you the advantages of radio waves and the reliability of light. Like the other wireless peripheral-sharing products, Infralink does the job.

LAWN: SPREAD-SPECTRUM RADIO

LAWN is a complete wireless communications system that uses spread-spectrum radio waves to transmit data through walls and around obstacles. A good bargain at $398 per peripheral, LAWN combines peripheral-sharing, electronic-mail, and file-transfer functions with an easy-to-use menu interface.

Measuring 2 by 4 by 7 inches and weighing about 1 pound, each LAWN transceiver includes one red and three green status LEDs. Different LEDs indicate when the machine is communicating with other LAWN units, when the unit is transmitting, when there is traffic on the channel, and when e-mail messages await the user. With the supplied cable, you simply connect the transceiver to the RS-232 serial port on your computer or peripheral; you don't need to install an interface card. The system channel has a mediocre rate of 38.4 kilobits per second—about as fast as a high-speed modem with data compression. Individual data transfers take place at 19.2 Kbps. O'Neill Communications also markets a serial-to-parallel converter.

LAWN transceivers transmit data up to 500 feet outdoors or 200 feet indoors; you can extend each unit's range yet another 500 feet by using a LAWN box as a repeater. LAWN's use of spread-spectrum radio technology makes it a relatively secure environment, and the product includes over 65,000 security codes for added security.

Installing easily but operating slowly, each LAWN unit can communicate with only one other unit at the same time. Nonetheless, LAWN provides good wireless communications. Its simple menus and complete features will work well for most small companies that need to communicate without sharing virtual drives. ■

CarrierNET
Carrier Current Technologies Inc., 6505 Pharr Mill Rd., Harrisburg, NC 28075; 800-222-0377, 704-455-5505.
List Price: Per PC or peripheral, $199. **Requires:** 27K RAM, parallel or serial port.
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Infralink
Infralink of America Inc., 6525 T Corners Pkwy., #400, Norcross, GA 30092; 404-449-7858.
List Price: Each unit, $499; set of three with cables, $1,499. **Requires:** Centronics parallel cable.
CIRCLE 470 ON READER SERVICE CARD

LAWN
O'Neill Communications Inc., 100 Thanet Circle, #304, Princeton, NJ 08540; 800-624-5296, 609-497-6800.
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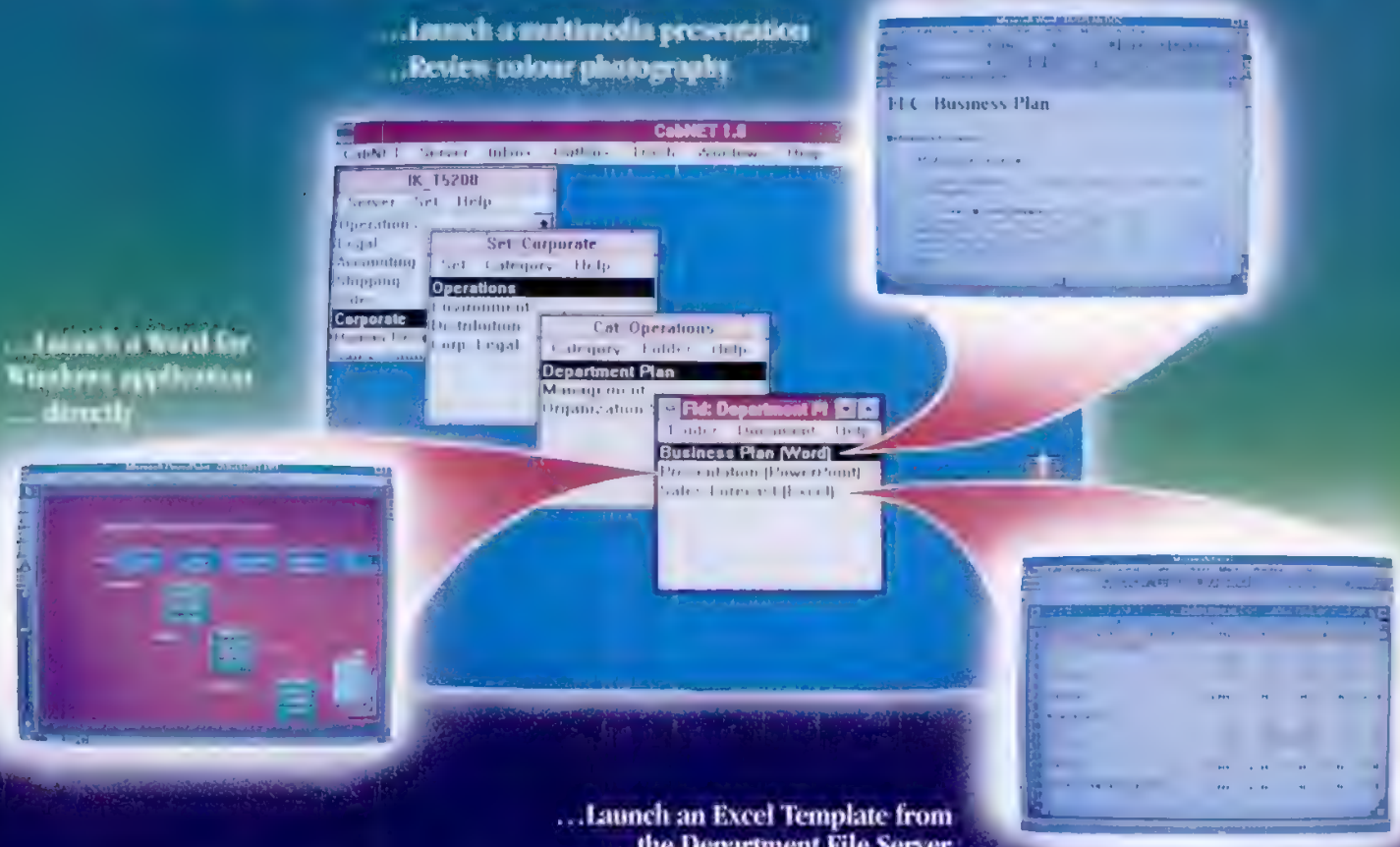

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Persoft. Another option for extending networks is using a WaveLAN card to create a router in the server.

InfraLAN, Altair, and WaveLAN all appeared after our last look at wireless networking ("The Next Wave: LANs Without Wires," May 29, 1990). Since it showed up, Altair has made some waves outside the electromagnetic spectrum, winning a 1991 Technical Excellence Award from *PC Magazine* ("8th Annual Awards for Technical Excellence," December 31, 1991). Altair's innovative design enables it to broadcast reliably at low power from a small, reasonably priced device at 18 gigahertz, a little-used, FCC-licensed part of the spectrum. One achievement by Motorola in particular stands out: integration of the microwave transceiver—normally a $25,000 device the size of a washing machine—onto a thin plate slightly larger than a man's pocket watch.

Altair's greatest strength comes from its complete transparency both to hardware platforms and to network operating systems that meet the 802.3 Ethernet standard. Operating in a licensed frequency band also means that the system enjoys protection from outside interference. Motorola owns the licenses and administers all issues related to them, which reduces your paperwork. Still, if you need to move Altair's control modules, you may need to notify Motorola's Frequency Management Center.

The product's signals stay well contained. They range from only 40 to 130 feet and cannot penetrate floors, ceilings, or supporting walls. Different modules, even if near one another, can reuse the same frequency to serve separate but closely spaced workgroups. The system offers no reasonable chance of outside snooping since its transmissions fail to pass through structural walls. But if you need to network departments spread across a wide floor, multiple floors, or many fully enclosed offices, Altair's signal confinement turns into a debit.

Motorola's design allows as many as six Ethernet devices on each User Module, up to a limit of 32 per Control Module. While the system places no restriction on total users, each group of 32 requires another control unit.

The third product in this roundup, BICC's InfraLAN, opts for infrared rather than radio technology. InfraLAN transmits data indoors between Token-Ring MAUs set up to 80 feet apart; each unit consists of twin optical heads cabled to a six-port MAU. The system imposes no user limit aside from the 72-workstation limit needed by IBM's Token-Ring specifications, but it does requires one MAU for every group of four stations.

SPEED DEMON

Speed sums up InfraLAN's main selling point. On PC Magazine LAN Labs' benchmark tests, BICC's offering demonstrated no significant degradation from a cabled 4-megabit-per-second Token-Ring network; both achieved a maximum of about 1 Mbps on our tests. Part of the reason is that, unaffected by radio noise, the hardware spends no time engaged in noise-filtering operations that can sap bandwidth. InfraLAN's requirement of an unobstructed line of sight between the infrared send/receive components also ensures that signals travel only between intended parties. But while this arrangement boosts performance, it sacrifices flexibility.

Both radio products, by contrast, permit varying degrees of freedom in placement but run slower than their wired counterparts. WaveLAN exhibits the greatest flexibility, but on our throughput tests it turned in numbers below Altair's. WaveLAN's speeds ranged from 28 to 35 percent of those of our wired 10-Mbps Ethernet setup, which achieved a maximum throughput of less than 2 Mbps.

When all loads were connected to one Altair User Module, Motorola's entry clocked in at 31 to 43 percent of the wired

EDITORS' CHOICE

- **No universal solution.**

The three companies that submitted products for our review of wireless LANs have carved out unique niches in this budding market. You can select NCR Corp.'s WaveLAN for its ability to transmit and receive data across distances of up to 5 miles using special antennas. You can opt for Motorola's Ethernet-based Altair for the brilliant design that won it *PC Magazine*'s 1991 Award for Technical Excellence. Or you can choose BICC Communications' InfraLAN for the ease with which it matches rated Token-Ring throughput.

These three products, however, are not interchangeable, and none of them suits every need. All three products do provide excellent security; this flies in the face of misconceptions about the vulnerability of wireless transmissions to eavesdropping (especially in view of the potential for tapping even cabled networks). All of the products we reviewed offer ease of setup and use. And the cost advantage of all three over a wired configuration becomes even greater once you add users or relocate at least part of your network. But if Ethernet is your chosen LAN interface, you have already dropped InfraLAN from the running, at least until BICC releases an Ethernet version. Similarly, Token-Ring networks cannot presently accommodate Altair.

The layout of your own office, and the way the users are organized into departments or workgroups, will also significantly narrow your options. A floor built with many supporting walls that separate members of a department may not allow the operation of any system besides WaveLAN. A network situated near equipment that generates heavy electromagnetic transmissions in the range of 902 to 928 MHz calls for either Altair or InfraLAN. And any layout that requires communication beyond 80 feet, even with line-of-sight positioning, cannot count on InfraLAN.

The answer is making a careful analysis of each product's pluses and minuses, not to mention taking a close look at how your networking needs may evolve over time. After all, waiting for an industry standard to emerge is a luxury that few can afford. And if a given product suits your needs, you have little reason to wait. The technology may be new, but the promise is already there.

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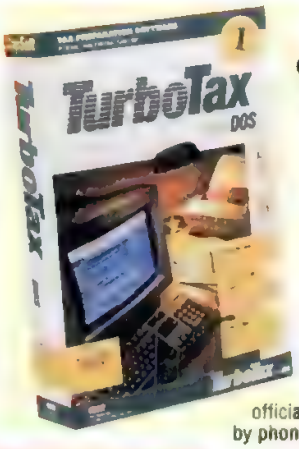

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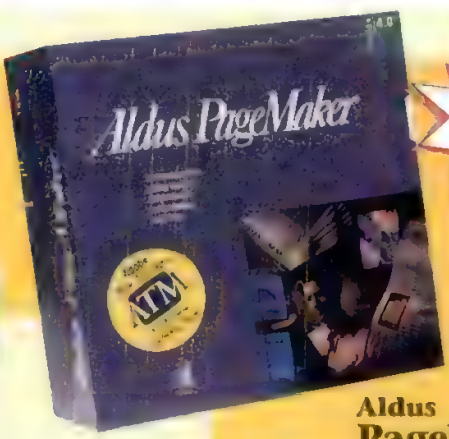

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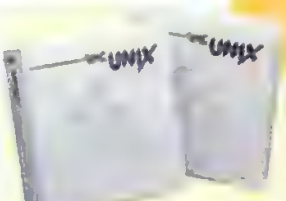

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#20204

WIRELESS LANs: SUMMARY OF FEATURES

Products listed in alphabetical order

The three wireless LAN products reviewed here differ widely on a number of points, including the required LAN interface, signal characteristics, and components constituting the standard package.

■—Yes ⌟—No

	Altair	InfraLAN	WaveLAN
List price (tested configuration)	$4,990	$5,990	$5,970
Included components	1 Control Module, 5 User Modules	MAU, 2 optical nodes, 2 node-to-base cables	6 adapters
Maximum number of devices served	32 per Control Module	6 per MAU	1 per adapter
GENERAL INFORMATION			
Frequency class	18 to 19 GHz	Infrared	902 to 928 MHz
LAN interface	Ethernet	Token-Ring	Ethernet (modified)
Supports building-to-building use	⌟	■	■
Supports server operating systems:			
NetWare	■	■	■
VINES	■	■	■ (via bridge)
LAN Manager	■	■	■
Unix	■	■	⌟
AppleShare	⌟	■	■
Rated throughput	3.3 Mbps	4 Mbps	2 Mbps
Can be operated without FCC licensing	⌟	■	■
Can be added into existing network	■	■	■
Network type	Ethernet	Token-Ring	Ethernet or Token-Ring (via bridge)
PHYSICAL FEATURES			
Device type	Antenna	Optical node	16-bit network adapter
Uses Multistation Access Unit	⌟	■	⌟
Dimensions (HWD, in inches)	3 x 8 x 11.5	3 x 14.9 x 7.3	N/A
Weight (pounds)	5	6.1	N/A
Number of ports	6 per User Module; 32 per Control Module	6	N/A
Diagnostic LEDs on transceiver	■	■	N/A
Link status	■	⌟	N/A
Proper alignment	⌟	■	N/A
Transmission monitoring	■	■	N/A
Power source	External AC	MAU	Host PC
LIMITATIONS			
Maximum specified distance (feet):			
Open area	130	Not recommended	800
Semi-closed area	65 to 70	80	200
Closed area	40 to 50	80	110
Operates without line-of-sight positioning	■	⌟	■
Signal can penetrate			
Internal office separators	■	⌟	■
Concrete	⌟	⌟	■
Steel	⌟	⌟	⌟
SECURITY			
Data encryption	⌟	⌟	Optional ($90)
Access restricted to users with registered node addresses	■	⌟	⌟
SUPPORT			
Training	■	■	⌟
Toll-free support number	■	■	⌟

N/A—Not applicable: This product is an internal adapter card

Ethernet LAN's throughput. In a much costlier setup comprising one User Module per station, the range became 31 to 47 percent. Both Altair configurations showed slightly but progressively lower throughput under heavier loads from one to four stations—as did the other products reviewed. LANs generally run at less than full capacity, so the apparent slowness may not affect you. Still, avoid communications-intensive tasks over current radio networks.

Initial per-user costs for any of the reviewed options tend to exceed what you would pay for an equivalent wired LAN. A simple WaveLAN installation runs $995 per user; Altair falls between $299 (when you have many users) and $4,990, depending on the exact configuration; and InfraLAN ranges from $499 to $2,995 per user, depending again on configuration. WaveLAN's pricing stays relatively constant whatever the number of stations; the others become more cost-effective as you fill empty ports. With less need to pay for pulling cable, wireless solutions rapidly catch up to their wired competition, and get better with every move or change.

The reviewed items share some common traits. All offer easy setup and performed without a hitch on our tests. (WaveLAN's use of its own network adapter, however, does make it more prone to rejection by a flaky machine.) Each solution offers security surpassing that of wired LANs, despite the common misconception that radio-based network devices allow interception as easily as cordless phones.

Licensed frequency bands, as noted, protect Altair from electrical noise. And Altair's frequency lies well beyond the range that can affect other equipment. BICC's use of infrared provides the same protection. WaveLAN has built-in features to avoid the problem but still remains subject to interference and may also cause some itself.

Interference from broadcast transmissions brings up the question of health effects. At a meager 1 watt, WaveLAN still stands as the strongest of the three wireless devices and carries the farthest. And according to NCR, in many installations WaveLAN can operate at half a watt. Altair sends only 25 milliwatts and then only when necessary, but each unit adds more. Frequency may also come into play. InfraLAN seems most innocuous, using only as much infrared light as an infrared remote-control unit.

FUTURE CURRENTS:
Where Wireless Technology Is Headed

by Angela Gunn

The products reviewed in this roundup of wireless LANs permit a certain freedom from the constraints of cabling, serving a need that supersedes the cost and distance issues associated with wireless connectivity today. But the demands and technology that brought these products to market are only beginning to pick up steam. In the near future, more users will expect to be freed from their wired connections.

Sales of wireless products will grow from $79 million in 1991 to around $235 million by 1995, predicts Insight Research Corp., an independent research firm based in northern California. These products will run the gamut from full-featured network administration systems to convenient products for home use and products that require virtually no user at all.

The real break from cabling was the portable computer, and laptops and palmtops will reap many of the benefits of wireless advances. Additionally, wireless computers will go where computers have not gone before, as various industries explore the benefits of on-site data input.

OLD TECHNOLOGY, NEW TRICKS

Manufacturers of high-end products have been farming out the task of wireless peripheral development to outside companies. In turn, many of these outside companies are reworking mature technologies into solutions for wireless connectivity, a trend that will probably continue while the wireless office catches up to the wired office. Hewlett-Packard's HP 95LX Palmtop PC uses Extended Systems' JetEye to print from any laser printer equipped with the infrared transceiver. The IBM 9075 PCradio runs on the ARDIS network (a joint IBM-Motorola production) and has fax and modem capability. The PCradio is designed for mobile use.

AT&T Safari Systems' AT&T Safari NSX/20 shows probably the most forward-thinking design among the new breed of wireless laptops. It sports a cellular modem, which is hardly an unusual feature on a modern laptop, but the Safari also allows direct data reception through its Mobile Mailbox. The mailbox is a pager with an AT&T Mail address; brief messages sent to that address can be downloaded directly from the pager into the Safari. This mailbox is a powerful tool for keeping a nearly real-time running tab on messages. If AT&T increases the size of the allowed message (currently 240 characters), it could make e-mail as convenient as the telephone.

Simpler wireless units also have a home in the workplace, particularly on sites where computer use was not previously practical. One of the early business uses for wireless transmission was in the context of real-time stock-market-monitoring software, which drew its data from an FM radio receiver. In Britain, California Microwave has installed its RadioLink LAN on the sales floor at Marks and Spencer. Sales staff can keep a running check on inventory and prices. Closer to home, Kmart and Travelers Corp. have installed similar systems.

For the most part, these units use the wireless peripheral-sharing units described in the sidebar "No Frills, Less Hassle: Three Products for File Transfer, Printer Sharing, Electronic Mail." These products enable mobile units to attach to databases on wired LANs and use the resources there; the same approach is used by other peripheral-sharing systems such as California Microwave's RadioLink. The importance of these two kinds of connectivity—peripheral sharing and data sharing—will define the direction of the lower-end wireless market. The portable units may monopolize the data market, but the familiar desktop computer will be likewise "unwired" into products such as the Infralink printer-sharer and GEC-Marconi's Verran AC Datalink. (Datalink uses the AC wiring to share printers, plotters, faxes, and modems.) And wireless peripherals such as mice and keyboards will continue to make inroads.

For sensitive or dangerous tasks, wireless connectivity may leave the computer behind. Dallas Semiconductor is manufacturing a wireless chip that can read data directly into other memory chips. The DS199x Touch allows data to be stored somewhere useful, such as an ID badge or a large piece of equipment. The data on the chip can be read and altered without hardwiring it to a computer, creating a database. Inventory could be kept without actual human intervention—useful in high-security or hazardous areas.

INTERNATIONAL COOPERATION

Wireless connectivity will reach beyond the office with the help of satellites. At least two organizations are making the push for an international mobile communications system. The "Iridium project," put forth by Motorola, calls for 77 satellites to blanket the planet and provide point-to-point connectivity anywhere. The cost of this project is estimated at $2.1 billion. Meanwhile, the International Maritime Satellite Organization, a London-based consortium of 64 nations, has advanced "Project 21," a $1 billion effort that would use 30 to 40 satellites and existing phone technologies.

International cooperation is the key to extending wireless connectivity around the globe. At present there is no wireless standard in the Western countries, though members of the European community are hashing out details of a standard. RadioLink, the first product of its type allowed in Britain, broadcasts at 2.412 GHz—a hobby-radio frequency. There is no one wireless standard in the U.S., either, but the IEEE's 802.11 committee may change that.

Beyond the IEEE, there is the bulky bureaucracy of the FCC. In the past, bandwidth rights were doled out without much thought to heavy commercial usage. Now that commercial usage is skyrocketing, those concerns that

have bandwidth rights are jealously hoarding them. Microwave operators in particular complain that LAN transmissions cause serious interference to their transmissions. Testing thus far has been inconclusive.

STAKING OUT THE SPECTRUM

The bandwidth used by most spread-spectrum radio transmitters, on the other hand, is far too open. The 900-MHz range is home to burglar alarms, hi-fi radio broadcasts, and baby monitors. Spread-spectrum is designed to rise above this kind of clutter, but the potential for interference will only get worse. At the time of this writing, Apple has applied to the FCC for primary rights to the 40-MHz range (at the behest of the IEEE 802.11 committee, many believe). That segment of the spectrum would be given over for Data-PCS (data personal communications services), the generic designation for wireless communications. Without assigned rights to part of the electromagnetic spectrum, companies interested in further developing wireless technology must allow for the motley collection of other products, present and future.

Once standards are developed, research will elaborate on the best uses of the developing wireless technology. And once a bandwidth has been allocated, researchers can concentrate on making the best use of that portion of the spectrum. Buyers will want to see that the technology is here to stay. They also want to see either performance benefits or price benefits—or preferably both.

The maintenance costs of a wireless LAN are already demonstrably lower than those of cabled setups. New technology will allow the prices to fall substantially, making the products more attractive to the hesitant buyer. It is probable that, after a market flood of wireless products in the next few years, the pack will thin considerably; in the process, startup prices should drop. ■

For this review, we sought products capable of providing a wireless replacement for Ethernet or Token-Ring network cabling in an office setting. We required that each product run under *NetWare* 3.11 and support virtual drives. This disqualified solutions aimed at furnishing only remote services, such as printing.

Whatever the technology (radio, light beam, or any other), products had to run over IEEE 802.3–compliant Ethernet or 802.5 Token-Ring in at least indoor settings. In addition, we excluded OEM products that were not marketed by the primary manufacturer. This requirement disqualified items such as Persoft's Intersect, a bridge allowing WaveLAN to extend conventional networks, since it uses NCR's network card. PureData also uses NCR's network interface card but with different software.

Another absentee, Telesystems SLW's ARLAN 450, was in the process of being updated, and the vendor was unable to ship it to us in time for testing. The system uses spread-spectrum technology to span maximum indoor distances of 200 to 1,000 feet or more on a *NetWare* or other LAN. Like WaveLAN, ARLAN can work on an Ethernet or Token-Ring network.

Photonics Corp.'s Photolink runs on AppleTalk/LocalTalk networks of PCs and Macintoshes (plus other Apple models); Photolink uses infrared beams directed from a device on each workstation to a central point on the ceiling or wall. Photonics makes its standard Photolink model for linking workgroups but also markets a building-to-building version. Since the system does not run on *NetWare* as the products in the main reviews do, we cover it in the sidebar "Photolink: The Macintosh/PC Route to Wireless Networking."

Yet another product outside the scope of our review comes from Laser Communications. Called LACE, the product sells in different versions that extend Ethernet, Token-Ring, and other networks up to a kilometer in building-to-building rather than indoor connections.

Finally, a variety of related products include some features of wireless LANs, since they let you share peripherals over a wireless link. But they do not offer virtual drive capability, which allows you to access a network drive as another drive letter on your own machine. Carrier Current Technologies' CarrierNET, Infralink of America's Infralink, and O'Neill Communications' LAWN are discussed in the sidebar "No Frills, Less Hassle: Three Products for File Transfer, Printer Sharing, Electronic Mail."

At the moment, Altair and BICC seem most capable of pushing wireless connectivity to higher speeds, with their large available bandwidths. But NCR and other spread-spectrum advocates hope to convince the government to set aside a band requiring no licensing—while making it available only to those adhering to a standard protocol. NCR pressed to create the recently formed IEEE 802.11 workgroup, which hopes to create a wireless standard. The process takes time, however, leaving challengers such as Motorola enough room to become standards by default.

BICC COMMUNICATIONS

InfraLAN

by M. Keith Thompson BICC Communications' InfraLAN provides an excellent wireless solution for connecting multiple Token-Ring LAN segments that conform to the IEEE 802.5 specification. InfraLAN uses infrared light to provide fast throughput on 4-megabit-per-second Token-Ring networks. Even at $2,995 per network segment, InfraLAN offers a viable alternative to hard-wiring your building.

At first glance, InfraLAN looks like something off a spaceship. It consists of three pieces: a Token-Ring MAU and two infrared receiver/transmitters, which BICC calls *optical nodes*. The MAU measures 3 by 14.9 by 7.3inches (HWD) and provides six Token-Ring connections.

FACT FILE

InfraLAN
BICC Communications, 103 Millbury St., Auburn, MA 01501; 800-447-6526, 508-832-8650.
List Price: $2,995 per LAN segment (minimum of 2).
Requires: Token-Ring network with IBM connector 6339098.
In Short: This easy-to-install wireless product provides as much throughput as the cabled Token-Ring networks that it links through a line-of-sight connection. Excellent design and transparent operation make InfraLAN a good choice, although distances beyond 80 feet are not recommended.

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Each optical node measures roughly 3.5 inches cubed and comes with 15 feet of cable to connect to the MAU. The nodes mount on partitions, the wall, the ceiling, or any other flat surface; they point to nodes linking other InfraLAN MAUs.

The InfraLAN MAU includes six ports; ports 1 and 6 can function as Ring-In and Ring-Out, respectively, to allow multiple rings to attach. By utilizing this feature, organizations can easily cover the entire floor of the building.

BICC Communications' InfraLAN includes a Multistation Access Unit with cable connections for Token-Ring devices and connections for two small receiver/transmitters, known as optical nodes. The optical nodes communicate via infrared light with other InfraLAN units.

Infrared light–based products such as InfraLAN offer some significant advantages over radio-based products. Infrared's biggest advantage is its immunity to radio-frequency interference. Most radio-based networks use error correction, but interference from outside sources can still cause slower network performance. Another bonus is security: Of the three products reviewed, InfraLAN faces the least likelihood that someone with the proper radio-based equipment can intercept your network data.

Each optical node includes an LED meter to help you align the nodes perfectly. While aligning the optical nodes is not difficult, you must pay special attention to some basic principles. You cannot, for example, point more than two optical nodes at each other. The nodes cannot be located perpendicular to a white wall; you must turn them slightly to prevent the same infrared light signal from reflecting back to the transmitting node. Also, you cannot place the unit in the path of direct sunlight—say, facing across a window. InfraLAN's manual provides ample information and illustrations to enable most users to complete alignment in less than 15 minutes.

Unlike radio-based networks, InfraLAN requires that the optical nodes be set up in a line of sight with each other. This

PHOTOLINK: The Macintosh/PC Route to Wireless Networking

by M. Keith Thompson and Angela Gunn

Wireless data transfer is hardly limited to IBM-standard PC networks. In fact, Photolink, one of the pioneer offerings in the infrared network market, is intended primarily for Macintosh and other Apple machines, though it will also support PCs. Photonics Corp. first entered the wireless LAN market with Photolink, the company's infrared transceiver product for AppleTalk.

Photolink offers a flexible way to connect AppleTalk workgroups in open office space, using infrared transceivers that cost $1,195 apiece; each connects four devices to the network. Unlike BICC Communications' InfraLAN, Photolink does not require a direct line of sight between each pair of transceivers. Instead, each unit needs a clear path to a common place on the ceiling or wall. Photolink uses reflected infrared light to transmit signals between units located among low, modular cubicles.

Photolink is far from choosy about the reflecting surface; it is said to work even on acoustic tiles. The wedge-shaped transceivers measure 7 by 3.5 by 1.3 inches, weigh about 12 pounds, and mount on cubicles with an included clamp; they are effective for communications across an area 70 feet in diameter. Each transceiver includes a built-in alignment meter for proper adjusting. When you have focused the unit on the spot the other transceivers are focused on, an indicator light flashes green.

Photolink offers full AppleTalk/LocalTalk network throughput with a 230-kilobit-per-second transfer rate. Each Photolink transceiver includes ports for four devices; you must run a cable from each networked computer to the nearby Photolink unit. With this ability to connect four computers to one transceiver, Photolink's main job is to connect workgroups. Units can be daisy-chained, and up to 132 devices can be attached.

BUILDING-TO-BUILDING

Photonics also markets a LAN-to-LAN product that allows transparent AppleTalk connectivity between buildings. Like Photolink, Photolink Building-to-Building operates at the full AppleTalk/LocalTalk speed of 230 Kbps, but the Building-to-Building version uses slightly different infrared technology.

Photolink Building-to-Building connects AppleTalk networks located in separate buildings; the transceivers work up to 600 feet apart. But unlike the intrabuilding Photolink, Photolink Building-to-Building transmits in a direct line of sight; that is, the units must be focused precisely at each other. The Building-to-Building transceivers mount on the inside of windows, through which they transmit data. This solution avoids costly wired options or expensive outdoor systems.

Photolink technology lives up to its promise. The indoor version uses diffused infrared light to link multiple groups of four devices on AppleTalk, and it can be mounted just about anywhere, providing a true wireless LAN. The Building-to-Building version is a viable solution for linking microcomputer networks across long outdoor distances—as long as you can align the indoor transceivers. ■

Photolink
Photolink Building-to-Building
Photonics Corp., 200 E. Hacienda Ave., Campbell, CA 95008; 800-628-3033, 408-370-3033.
List Price: Photolink, $1,195 per unit; Photolink Building-to-Building, $3,990 (includes two units).
Requires: AppleTalk network.
CIRCLE 471 ON READER SERVICE CARD

THE ELECTROMAGNETIC SPECTRUM: WHERE WIRELESS FITS IN

The electromagnetic spectrum encompasses most kinds of information-bearing media. Much of the commercial and scientific use of the spectrum occurs between 600 megahertz (MHz) and 5 gigahertz (GHz). Above 1 million MHz (1 terahertz), waves are identified by length rather than frequency. The higher the frequency, the shorter the wavelength. (Frequency multiplied by wavelength equals 300.) A shorter wave can carry more information; for instance, light waves convey more detailed information than sound waves do.

The bands reserved by the FCC for commercial data transmission are 902 to 928 MHz, 2.4 to 2.4835 GHz, and 5.725 to 5.85 GHz. Broadcast power is limited to 1 watt, hence the short range of many wireless LANs.

This table also includes several other common frequencies as reference points. Products that appear in bold are mentioned in this story.

FREQUENCY (in megahertz)

Start of range	End of range	
0.00005	0.00006	Electrical current, wall outlet
0.200	**0.217**	**CarrierNET (Carrier Current Technologies)**
0.530	1.600	AM radio
87.900	108.000	FM radio
470.000	512.000	TV channels 14 to 20
512.000	608.000	TV channels 21 to 36
608.000	614.000	Radio astronomy (one of several channels)
614.000	806.000	TV channels 37 to 69
824.000	849.000	Cellular phones, mobile radio networks
869.000	894.000	Cellular phones
896.000	901.000	Cordless phones
902.000	**928.000**	**WaveLAN (NCR Corp.)**
902.000	**928.000**	**ARLAN 600 series (Telesystems SLW)**
902.000	**928.000**	**RadioLink (California Microwave)**
902.000	**928.000**	**LAWN (O'Neill Communications)**
902.000	928.000	Industrial/scientific/security/medical use
902.000	928.000	Radiolocation
902.000	928.000	Amateur radio
960.000	1,215.000	Air traffic (worldwide)
1,559.000	1,625.500	Air traffic (worldwide)
* 1,850.000	1,990.000	Data-PCS frequency (proposed)
2,400.000	2,450.000	Amateur radio, radiolocation
2,400.000	**2,483.500**	**RadioLink (California Microwave)**
2,700.000	2,900.000	Doppler weather radar
18,000.000	**19,000.000**	**Altair (Motorola)**
18,000.000	19,000.000	FCC Digital Termination Services (DTS)
344,827,586.207		**InfraLAN (BICC Communications) (870 nanometers)**
389,610,389.610	491,803,278.689	Visible red (770 nm. to 610 nm.)
652,173,913.043	789,473,684.211	Visible violet (460 nm. to 380 nm.)

* This frequency is presently reserved for more than 8,100 uses, including those of the power, petroleum, and railroad industries and of local government.

restriction seriously limits the places you can use InfraLAN. You cannot, for instance, transmit InfraLAN signals through walls or around corners. (BICC admits that you can use mirrors to make your way around corners but currently discourages trying this.) Finally, you can locate the nodes only between 10 and 80 feet apart.

INFRARED PERFORMANCE

On the performance side of things, InfraLAN does the job. Because it uses infrared light with a very wide bandwidth to transmit the network signal, it is as fast as a 4-Mbps Token-Ring wired network.

In case you do interrupt the direct path between the optical nodes—not easily done if they are the recommended 7 feet up—InfraLAN offers a safety valve. When the path between any two optical nodes gets blocked, InfraLAN instantly routes the signal back around the ring to continue the loop. This keeps network errors from occurring and provides reliable service. If you are using only two InfraLAN units, however, you may experience momentary problems after such a block. If so, the network will receive a timeout, displaying a "Network not ready, Abort, Retry or Fail?" message. Answering "Retry" allows the connection to continue without the loss of any data.

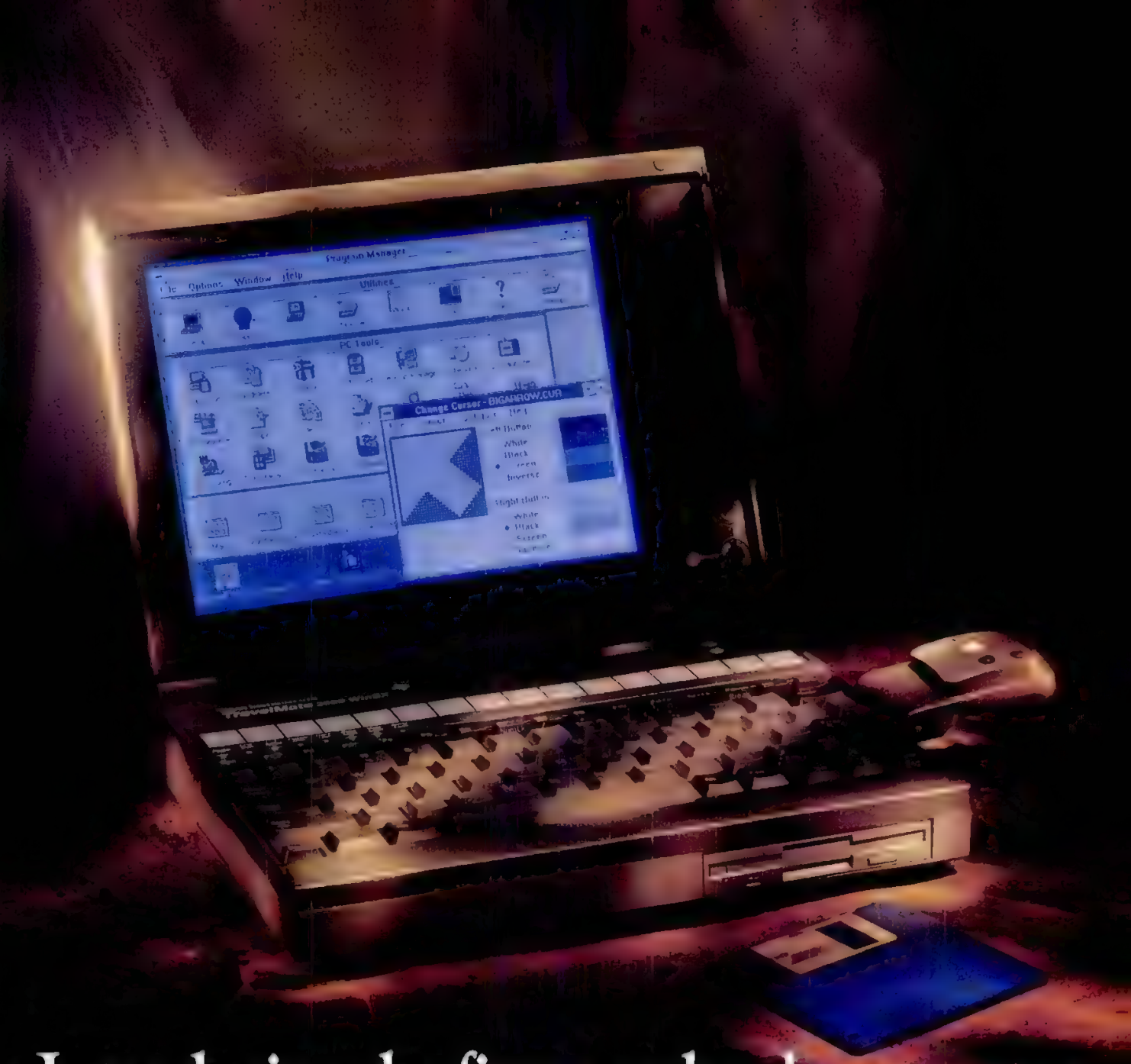
While the current version of InfraLAN works only with 4-Mbps Token-Ring networks, BICC is working on a 16-Mbps Token-Ring unit that may be shipping by the time you read this. Also, expect to see an InfraLAN Ethernet unit from BICC in the near future.

With excellent performance numbers, InfraLAN provides a great solution for wirelessly linking Token-Ring LAN segments. The only potential drawback within crowded offices is the line-of-sight requirement. Once you have located the infrared transmitter/receivers in places where their path of communication will not be interrupted, InfraLAN will perform its duties without your ever knowing that it is there.

MOTOROLA INC.

Altair

by Frank J. Derfler, Jr. and Gary Berline For 60 years, Motorola has been the leading company in very high-frequency radio communications in the U.S., and it enjoys a substantial share of that market around the world. Now the company has applied its engineering talents to local area networks.



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CIRCLE 304 ON READER SERVICE CARD

The radio signals in Motorola's Altair system can extend Ethernet LAN cabling to link workgroups and replace cable (or preclude cable installation) in many offices. Installing the Altair system takes only a few minutes; you do not have to modify the network in any way, and the product works with any LAN operating system. We recently recognized its design quality by giving it a *PC Magazine* 1991 Award for Technical Excellence ("8th Annual Awards for Technical Excellence," December 31, 1991).

The Altair system typically links workgroups located on the same floor. The system consists of one centrally located $3,995 Control Module that acts as the radio communications hub for up to 32 User Modules. Each $995 User Module connects to a LAN cable along with as many as six other Ethernet nodes. The simplest system comprises one Control Module and one User Module.

In an optimal configuration, Altair can cost as little as $299 per node, but price comparisons are tricky. You also must consider the cost of the standard LAN adapters and cabling in each Altair node. NCR's WaveLAN, which totally replaces the LAN adapters and cabling, offers a better economical and technical solution for linking a few isolated PCs into the network. But Altair excels at linking separate groups of networked PCs.

FACT FILE

Altair
Motorola Inc., 3209 N. Wilke Rd., Arlington Heights, IL 60004; 800-233-0877, 708-632-4723.
List Price: Control Module, $3,995; User Module, $995; SNMP option, $95.
Requires: Ethernet card.
In Short: Motorola's Altair works with any Ethernet network and LAN operating system to provide wireless connections between cabled LAN segments up to 130 feet apart. Altair gets high marks for compatibility and ease of installation, and it has adequate throughput.

CIRCLE 465 ON READER SERVICE CARD

COMPLEXITY INTO SIMPLICITY

You can make an Altair link operational in just a few minutes. The stylish modules

BENCHMARK TESTS: WIRELESS LANs

Wireless LAN technology provides a valuable way of transmitting data when cabled connections prove unwieldy or infeasible. But of the three products tested, only BICC Communications' InfraLAN matched the throughput of the cabled configuration included for comparison; InfraLAN is designed to maintain the throughput rate of a Token-Ring LAN. Motorola's Altair and NCR Corp.'s WaveLAN, which had a faster Ethernet standard to maintain, allowed only 33 to 47 percent of the throughput of a cabled LAN under load. InfraLAN's stronger showing can be attributed to its use of infrared light instead of radio waves.

WHAT THE NUMBERS MEAN

For testing purposes, the LANs reviewed fit within two categories: radio-frequency and infrared transmission. But despite the differences in technology and signal rating, the throughput of all three products dipped as the network load increased.

Both Altair and WaveLAN use radio waves to transmit data. Altair transmits at 18 GHz using a low-wattage microwave signal with a potential bandwidth of 3 megabits per second. WaveLAN's spread-spectrum frequency range of 902 to 928 MHz, however, results in the smaller bandwidth of 2Mb per second—a disadvantage to consider aside from the inherent differences in the products' design.

Part of the reason for InfraLAN's greater throughput is that InfraLAN runs under the Token-Ring environment. Token-Ring networks are typically more stable than Ethernet networks, owing to Ethernet's collision retry method. In addition, the product's bandwidth matches the 4Mb-per-second rating of the Token-Ring adapters used for testing.

HOW WE TESTED

We performed our benchmark tests on both an Ethernet and a Token-Ring network with three main components: a *NetWare* server, baseline stations for comparison with standard cabled networks, and load stations for testing. The server, a Compaq Deskpro 386/25e fitted with 8MB of RAM, also used a Novell NE2000 Ethernet adapter and a Proteon 1390 4Mb/16Mb Token-Ring adapter (set at 4Mb) during separate tests. Five Compaq Deskpro 386/25e's formatted under DOS 5.0 were the workstations we used; four of these served as load stations.

For comparison of Altair's and WaveLAN's results against those of cabled LAN configurations, we tested the same stations when connected with thin Ethernet cable to the *NetWare* server. For comparison with InfraLAN's scores, we linked the stations to a Startek Multistation Access Unit (MAU) connected to the server's Token-Ring adapter and set at 4MB.

We installed NCR's WaveLAN adapter card in each workstation using the company's own drivers. NCR's product conforms to neither 802.3 nor 802.5 standards but rather the forthcoming 802.11, which is expected to allow several LAN topologies to run with a wireless LAN's network adapter cards.

In testing Motorola's Altair, we used both a node and a segment scheme. In the node scheme, we connected each workstation's NE-2000 adapter card to a separate Altair User Module. In the segment scheme, we connected all the workstations to one another using Ethernet wiring, then attached one end of the cable to an Altair User Module; and on the server's end, we attached an Altair Control Module to an NE-2000 Ethernet card.

To test BICC's InfraLAN, we used the product's own MAU and, in the stations, Proteon 1390 Token-Ring adapters. We connected the five test stations to InfraLAN's MAU and linked that to one of the product's optical nodes. At the other end, we linked another optical node to a BICC MAU connected to the *NetWare* server.

weigh only 5 pounds and measure 3 by 8 by 11.5 inches. Each has its own BNC connector for thin Ethernet cabling and an AUI port for connection to thick Ethernet cabling, 10BaseT unshielded twisted-pair wiring, or fiber-optic cable through an appropriate transceiver. The whole system is essentially plug-and-play. You just give the Altair units power and an Ethernet connection; they do the rest. Each module has a green LED that remains lit when the connection is good and blinks when it is not.

The units contain special-purpose microprocessors that perform all of the communications tasks, making the units easy to install and use. These microprocessors identify and recognize each active radio-frequency device. They then select the antenna in each module that will produce the best signal strength for the communications path while avoiding signal distortion. The processor in the Control Module regulates the transmissions of each User Module, a technique that ensures orderly transmission and reliable communications. Our tests show, however, that this regulation also imposes a ceiling on throughput.

Just give the Altair units power and an Ethernet connection; they do the rest.

Motorola's engineering expertise shows in its use of an extremely high radio frequency and very low power. The Altair units operate at 18 GHz, a frequency band that requires special FCC licenses for operation. The signals in this frequency range are sharply focused. The units operate at a power level of 25 milliwatts (0.025 watts) for very short durations. Both the high frequency and the low power reduce the risk of interception and interference. The signals are scrambled to improve security further (but not encrypted according to any U.S. government standard).

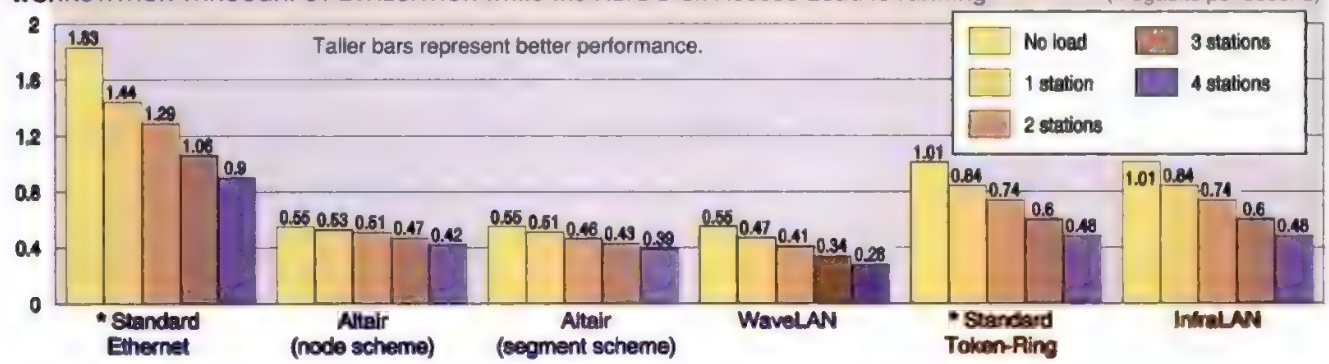
PC Magazine LAN Labs' benchmark tests are written in C and are independent of commercial software. Each load station operates at a rate many times that of a typical networked PC, even one in a heavy-use environment.

The **Workstation Throughput Evaluation test reports the throughput** recorded on a single PC during the performance of **a standardized task on the** network, and is run in conjunction with the Hard **Disk Access Load test or the** Directory Access Load test. The test **program performs a sequential read, a** random read, a sequential write, **and a random write using a 1MB file. The record** size systematically **rotates among 16K, 4K, and 512 bytes. The throughput is** reported in megabits per **second.**

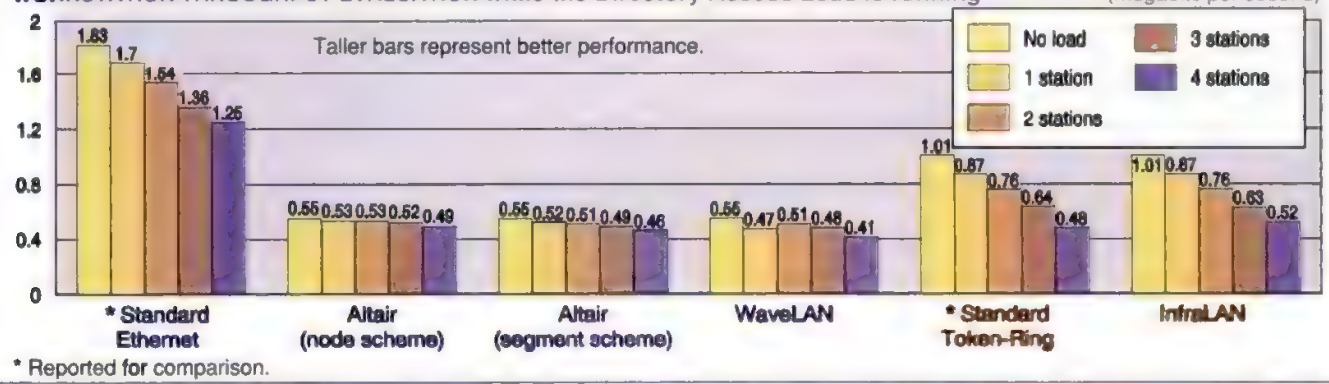
The **Hard Disk Access Load** test reads random blocks of data in 1K increments **from a** 10K file on the server. The results of this test are reported in requests per **second for all the PCs** running the load test. The test begins and ends **at** the **same time as the** Workstation Throughput Evaluation test.

The Directory Access Load test makes the server repeatedly search for a non-**existent file. Since the file allocation** table in most network servers is typically **cached, this request causes a fast** read to the cache. The repeated retries **created by the client PCs generate a heavy load on** the server's CPU. **This test provides a general-purpose method of loading the** server's **CPU in the fashion of a resident task, such as a network-monitoring program or a communications program. The results for this test are reported in requests per second for all the PCs running the load test. The test begins and ends at the same time as the Workstation Throughput Evaluation test.**

WORKSTATION THROUGHPUT EVALUATION while the Hard Disk Access Load is running (megabits per second)



WORKSTATION THROUGHPUT EVALUATION while the Directory Access Load is running (megabits per second)



* Reported for comparison.

This hexagonal plate, a component of Altair's Control Module, innovatively integrates the circuitry of an otherwise huge microwave transceiver.

The Control Module in Motorola's Altair acts as a hub to communicate over very high-frequency radio waves with Altair's User Modules. AUI and BNC connectors on the modules let you attach by cable to IEEE 802.3–standard Ethernet networks.

The extremely high frequencies used by the Altair system do not penetrate thick masonry walls or floors, and they have a limited ability to go through plaster and other light construction materials. Under ideal conditions, the Control Module and User Modules can communicate across 130 feet of open space, but that distance might shrink to as little as 40 feet in closed offices.

Motorola's Frequency Management Center coordinates with the FCC and controls the assignment of frequencies for the operation of Altair systems. Motorola also provides an 800 number for Altair users.

LAN FLEXIBILITY

The Altair system does its work at the physical level of the network, gathering and transporting Ethernet frames. Since it does not care what data is inside the frames, Altair works with any LAN operating system and transport-layer software meeting the IEEE 802.3 standard.

As an aid to interoperability and network management, Motorola plans to offer a $95 option that gives an Altair unit the ability to respond to network management systems using the Simple Network Management Protocol (SNMP). This option should be available in the first quarter of this year. Any SNMP management program, typically running under Windows or on a Unix workstation, can query a network's Management Information Base (MIB) to gather information on performance and errors. For Altair, this will be a significant addition to its network troubleshooting capabilities.

Because of the transmission regulation and data-handling activities in the modules, the Altair system provides a throughput of about half a megabit per second to a networked PC. The same PC would enjoy two to four times that throughput from a fully cabled system. In Altair's favor is that its links suffer only slight degradation under a heavy load. Throughput of 0.5 Mbps will still bring in practically any application program in about the time it takes to shift your gaze from the keyboard to the screen.

Motorola's Altair system provides excellent flexibility and offers a way around many barriers to installing LAN cabling. A major plus is Altair's ability to work with any LAN software. Cost and throughput are factors to consider, but this system should meet the needs of almost any organization.

NCR CORP. WaveLAN

by Frank J. Derfler, Jr. NCR Corp.'s WaveLAN brings wireless connectivity to each PC. In contrast to the other wireless products in this review, WaveLAN connects each PC to the network using only radio waves; the others are standalone boxes that connect to the network cabling and link separate groups of wired nodes. As with Altair and InfraLAN, you can establish links between wired workgroups using WaveLAN. But to do this, you must add software from NCR, Novell, or Persoft that makes the PC act as a bridge or router.

Each $995 WaveLAN device is a LAN adapter card that goes into a PC with an ISA (Industry Standard Architecture) or MCA (Micro Channel architecture) bus and attaches to a small external antenna module. A minimal system needs two cards. WaveLAN offers the best flexibility and range of the systems tested, but it is a bit more difficult to install than the other products. And its radio system caps the maximum network throughput each PC can enjoy.

The flexible WaveLAN adapter card connects each PC to the network using only radio waves.

The other reviewed products work with any LAN operating system and transport-layer software. Because NCR includes drivers for both *NetWare* and NDIS (the Network Driver Interface Specification), WaveLAN works with *NetWare* and *NetWare Lite*, *VINES*, many OEM versions of *LAN Manager*, and other systems supporting NDIS. But given the present library of drivers, WaveLAN will function with Artisoft's *LANtastic* only after a great deal of ingenuity and work. The NDIS driver opens WaveLAN to third-party products from companies such as FTP Software and The Wollongong Group and to shareware products such as *The Clarkson Packet Driver Collection* that you can use to route DECnet, IP, and other

The hardware component of NCR Corp.'s WaveLAN is a network adapter card that you install in your PC. A small external antenna module runs from the internal card to a surface nearby, so you can communicate over spread-spectrum radio with other NCR cards.

packets over WaveLAN.

Each WaveLAN adapter installs like a LAN adapter card. Unfortunately, NCR's engineers did not design WaveLAN to emulate a popular adapter such as the Novell NE-2000, so you are limited to using the drivers that the company supplies. NCR claims that it uses industry-standard drivers with radio-transmission standards built-in. You follow the procedures used in your LAN operating system to link to a driver or to install layers of software over NDIS. In ISA machines, you have the usual installation task of hunting for free IRQs and memory addresses; the default is IRQ 10, and selections up to IRQ 15 are available. NCR plans to add automatic installation capabilities to the ISA card's software in the first quarter of this year.

After you put the cover back on the PC, you attach a small antenna module—about the size of a pack of playing cards—to the adapter instead of attaching a LAN cable. You have to keep the antenna from making full contact along its length with metal objects, so do not lay it flat side down on the PC. And you should try to give the antenna the best available line of sight to other WaveLAN nodes if you need to separate them very far. You can mount the antenna on the wall to do this, but otherwise WaveLAN is designed to be kept out of sight. The person using the PC sees only a full array of network services, as if the adapter used copper wire instead of airborne electrons.

On the PC, the WaveLAN user sees the array of network services as if the adapter used copper wire instead of airborne electrons.

The WaveLAN system operates in a frequency band of 902 to 928 MHz, just above the cellular telephone band. Although its maximum power is 1 watt, it generally operates at half a watt. Because of the low power and the specific frequency in use, it does not need a license in the U.S. and many other countries.

SPREAD-SPECTRUM SECURITY

NCR's use of spread-spectrum technology reduces the potential for receiving and creating interference and improves the security of the WaveLAN signals. Spread-spectrum radio transmits and receives over a bandwidth of several megahertz. The equipment can ignore common narrower signals within the bandwidth as long as they are not constant, even if they are quite strong. NCR offers a $90 Digital Encryption Standard (DES) chip to provide tight security for transmissions, but this chip is not for use outside the U.S.

During installation, the NCR software generates a special code that configures the network designation, or ID, that each WaveLAN adapter will use. After installing the first board, you use the same floppy disk to set up the other WaveLAN adapters to interoperate. Interestingly, you can establish separate WaveLAN net-

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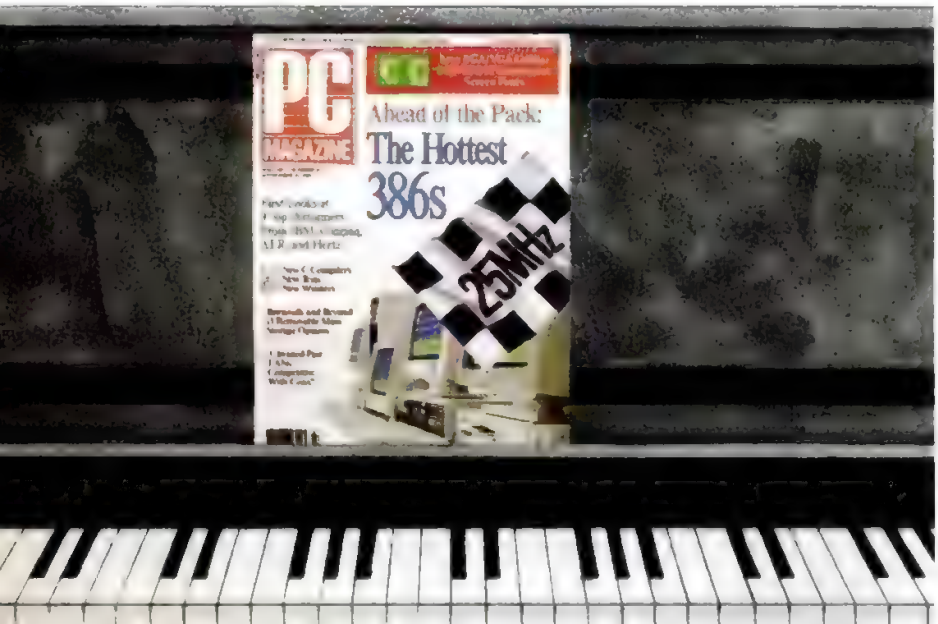

FACT FILE

WaveLAN
NCR Corp., 1700 S. Patterson Blvd., Dayton, OH 45479; 800-225-5627.
List Price: Per workstation, $995; optional DES security feature, $90.
Requires: *NetWare*, Version 2.*x* or 3.*x*, or any NDIS- or ODI-compatible LAN operating system; DOS 3.0 or later.
In Short: WaveLAN completely replaces LAN adapters and cables; each ISA or MCA card acts like a complete radio transceiver and installs like a LAN adapter. Each PC node links into the radio network at a distance of up to 800 feet, depending on the environment.

CIRCLE 466 ON READER SERVICE CARD

works that geographically overlap by setting the adapters for different logical network designations.

The WaveLAN system weaves a network in the air. The adapters listen for a quiet time to broadcast their messages, so their signals do not collide and you get the best performance. With the normal small antennas, the system can reach as far as 800 feet. As users of cellular telephones know, signals at these frequencies penetrate most masonry walls and floors. But when the signal is blocked by continuous metal surfaces such as metal walls without windows, the effective distance can vary to as low as 200 feet or less. Larger antennas are available to increase WaveLAN's range up to 5 miles.

NCR rates WaveLAN at a data speed of 2 Mbps. Our testing shows a consistent throughput of about half a megabit per second. The system displayed little degradation under heavy load, and it should meet the needs of anyone using typical office applications.

If NCR granted me a wish, I'd ask for an external WaveLAN for the parallel port of laptop and notebook computers. I would also wish that NCR had designed the adapter to emulate the NE-2000 to take advantage of its huge library of software. But wishes aside, WaveLAN provides a useful and economical alternative to LAN cables in any organization. ■

Frank J. Derfler, Jr., is workgroups systems editor of PC Magazine. *Angela Gunn is an editorial researcher at* PC Magazine. *Gary Berline is a consultant living in New York City. Ed Perratore and M. Keith Thompson are frequent contributors to* PC Magazine.

by
Joe Salemi

Advisor

- TDD FOR THE PC: Telephone access for hearing-impaired PC users.
- COMPILING BATCH FILES: Two utilities let you turn batch files into executable programs.

TDD FOR THE PC

One of our employees is deaf. To provide him with telephone services, we currently rent a TDD (Telecommunications Device for the Deaf) unit from the local phone company. We have many PCs in our office, though, and we're wondering if there's a modem or board that can turn a PC into a TDD.

Linda Smith
Peoria, Illinois

It would seem logical to use a PC as a TDD. The traditional TDD unit, which is slightly larger than the normal desktop phone, has a small keyboard, and a one-line LED or LCD screen for reading incoming or outgoing text. A PC would give the user the advantage of a multiple-line screen.

However, few if any standard modems and communications programs support the TDD protocols. This is somewhat surprising, as the first modemlike devices were used in the early teletype-based TDD units. Standard modems can be used with communications programs and BBS software packages to provide ASCII-based communications for the hearing impaired, but these cannot be accessed by non-PC TDD units.

One solution is the MIC300i TDD/Modem, provided with *FullTalk* software (Microflip Inc., 11211/11213 Petworth Ln., Glenn Dale, MD 20769; voice, 301-262-6029; TDD, 301-588-0965; $349). The MIC300i, an internal 8-bit TDD/Modem board for ISA systems, supports Bell 103 ASCII 110/300 bps, CITT V21 EUROPE ASCII 300 bps, USA TDD 45.5 bps, and International TDD 50 bps protocols. It can't be used to dial on-line services like CompuServe or MCI, but it can coexist with other modems in the same PC. The board has an infrared transmitter for controlling an external device such as a flashing light to alert the user to an incoming call.

The *FullTalk* software provides the user with up to 5 pages (18 lines per page) of 2-way conversation text. The text can also be captured to disk or printed for later review. Incoming and outgoing text can be set to different colors, making it easier for the user to follow the conversation. The whole screen flashes to indicate an incoming call. A status line on the bottom of the screen lists the active function keys, indicates call status, and provides access to the dialing directories.

FullTalk provides TDD answering machine services as well as ASCII-based e-mail and BBS features. Included in the package is *FlipTalk*, a TSR version of *FullTalk* that takes approximately 40K of RAM and can be popped up over text-based applications to provide TDD communications on the fly.

Up to now, TDDs have usually been sold or rented directly to people with hearing impairments. However, the Americans with Disabilities Act of 1990 (ADA) requires employers to provide "reasonable accommodation" to individuals with disabilities. Employers looking for more information on the ADA can contact the U.S. Department of Justice, Civil Rights Division, Coordination and Review Section, P.O. Box 66118, Washington, D.C. 20035 (voice, 202-514-0301; TDD, 202-514-0381 or 0383).

Telecommunications for the Deaf Inc. (TDI), a nonprofit organization that promotes communications accessibility for the hearing impaired, actively encourages modem manufacturers to support TDD protocols. Among its many services is the annual International Telephone Directory for TDD Users; a subscription is $15 for a residential/household listing and $30 for business/organization listing, and includes a copy of the directory and a quarterly newsletter. TDI can be reached at 8719 Colesville Rd., #300, Silver Spring, MD 20910 (voice, 301-589-3786; TDD, 301-589-3006).

COMPILING BATCH FILES

Is there a utility that will compile .BAT files into .EXE or .COM files? Can such a utility include text files referenced by a `TYPE *.TX` command, or would text files still need to be saved separately?

Ray Van Eperen
Altamonte Springs, Florida

Contributing editor Douglas Boling wrote just such a utility, called BAT2EXEC, for the August 1990 Utilities column. The current version is 1.5 and is available as BAT2EX.COM (program only) or BAT2EX.ZIP (program, source, and docs) in Library 2/PCMag Utils in the Utilities/Tips Forum on PC MagNet (see page 10 for details on how to join PC MagNet). If you don't have a modem, you can get a copy of the source code by sending a postcard with your name and address to Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016. BAT2EXEC won't compile text files, so you'll have to keep them separate.

Another option is to use BATCOM from Wenham Software Co. (5 Burley St., Wenham, MA 01984). The current version, 2.50, is priced at $59.95. You can contact the company at 508-774-7036.

ASK THE ADVISOR

Send your question to Advisor, One Park Avenue, New York, NY 10016, MCI mailbox PC MAGAZINE, or upload it to PC MagNet (see page 10 for access instructions). We regret that we're unable to answer letters individually. ■

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CIRCLE 245 ON READER SERVICE CARD

by
Jeff Prosise

Tutor

DETECTING STEP LEVELS: This utility tracks down the step level of your 386 chip.

DETECTING STEP LEVELS

In the October 15, 1991, issue, I talked about 386 step levels and some of the *errata* (bugs) afflicting early Intel 386s—specifically, erratum numbers 17 and 21, which sometimes cause a B-step 386 with paging enabled to lock up when executing a 387 instruction.

At the time, I said it was possible to sniff out B0- and B1-step 386s through software and that I'd present a program to do so if requested. 386STEP, which incorporates techniques devised by Bob Moote and Richard Smith of Phar Lap Software, does just this. By executing an XBTS instruction and testing for an invalid opcode exception, which occurs when the CPU attempts to execute an instruction that is not supported in the microcode, 386STEP can identify 386 chips with step levels of B0 or earlier.

First, 386STEP repoints interrupt 06h (the mechanism the processor uses to communicate that it was asked to execute a nonexistent instruction) to the code labeled INVALID_OP. It then initializes DX to 0 and executes XBTS, which is hard-coded in the source file with a DB directive. If no exception occurs, execution falls through to the line following XBTS—which sets DX to 1—and then continues.

If an exception *does* occur, the program branches to INVALID_OP, bypassing the code that modifies DX. After it restores the interrupt 06h vector, 386STEP tests the value in DX to determine whether or not an exception occurred. If DX is still 0, then the processor must be a step B1 or higher. If DX is equal to 1, then the XBTS instruction did not cause an exception and the CPU must therefore be a step B0 or earlier.

XBTS (Extract Bit String) and a related instruction, IBTS (Insert Bit String) were only present in the 386 through step B0. The official Intel line claimed these functions could easily be duplicated using the SHLD (Shift Left Double) and SHRD (Shift Right Double) instructions, so—presumably—XBTS and IBTS added no value. In reality, shrinking the chip mask (the master used to manufacture an integrated circuit) between step B0 and B1 caused logic gates for some instructions to physically overlap. Eliminating the problem required space occupied by XBTS and IBTS.

Intel later reused the opcodes originally belonging to XBTS and IBTS, assigning them instead to the CMPXCHG instruction of A-step 486s, causing conflicts with some programs written for the 386. However, CMPXCHG was modified in B-step 486s. The result: In current 486s, XBTS and IBTS cause an invalid opcode exception, just as they do on modern-day 386s.

The next test uses a bug found in B1-step 386s to separate them from chips—step D0 and higher—where the bug was removed. On a B1 386, the ECX register

386STEP.ASM — 1 OF 2

```
;*****************************************************************************
; 386STEP identifies the stepping level of a 386 chip as B0 or earlier,
; B1, or D0 or higher.  Thanks to Bob Moote and Richard Smith of Phar Lap
; Software for their advice and assistance in preparing this code.
;
; Copyright (c) 1992 Jeff Prosise
; First published in PC Magazine, January xx, 1992
;*****************************************************************************

                .386P

code            segment para use16 public 'code'
                assume  cs:code,ds:code
                org     100h
begin:          jmp     short main

msg             db      "Stepping level $"
stepB0          db      "B0 or earlier$"
stepB1          db      "B1.$"
stepD0          db      "D0 or higher$"
errmsg          db      "Error: Not a 386$"

;*****************************************************************************
; Procedure MAIN
;*****************************************************************************

main            proc    near
;
; Make sure this is a 386 or 486 by toggling the nested task (NT) bit.
;
                pushf                           ;Push FLAGS
                pop     ax                      ;Pop FLAGS into AX
                mov     bx,ax                   ;Copy result to BX
                and     bx,4000h                ;Zero all but bit 14
                xor     ax,4000h                ;Toggle bit 14 in AX
                push    ax                      ;Transfer the result back
                popf                            ;  to the FLAGS register
                pushf                           ;Push FLAGS
                pop     ax                      ;Pop FLAGS into AX again
                mov     cx,ax                   ;Transfer the result to CX
                and     cx,4000h                ;Zero all but bit 14 in CX
                xor     ax,4000h                ;Toggle bit 14 in AX
                push    ax                      ;Restore FLAGS with the
                popf                            ;  original NT bit intact
                cmp     bx,cx                   ;Compare BX and CX
                jne     short check486          ;Branch if they're not equal

cpu_error:      mov     ah,09h                  ;Display error message and
                mov     dx,offset errmsg        ;  exit
                int     21h
                mov     ax,4c01h
                int     21h
;
; Check for a 486 by toggling the alignment check (AC) bit.
;
check486:       mov     ebx,esp                 ;Save ESP
                and     esp,0FFFFFFFCh          ;Zero the lower two bits
                pushfd                          ;Push EFLAGS
                pop     eax                     ;Pop it into EAX
                mov     ecx,eax                 ;Copy EFLAGS to ECX
                and     ecx,40000h              ;Zero all but bit 18
                xor     eax,40000h              ;Toggle bit 18 in EAX
                push    eax                     ;Copy the result back to
                popfd                           ;  the EFLAGS register
                pushfd                          ;Push EFLAGS
                pop     eax                     ;Pop EFLAGS into EAX again
                mov     ebx,eax                 ;Transfer the result to EBX
                and     ebx,40000h              ;Zero all but bit 18 in EBX
```

Figure 1: This assembly language listing traces through one method for finding the step level of an Intel 80386.

386STEP.ASM 1 OF 2

```
                xor     eax,40000h              ;Toggle bit 18 in EAX
                push    eax                     ;Restore EFLAGS with the
                popfd                           ;  original AC bit intact
                mov     esp,ebx                 ;Restore ESP
                cmp     ebx,ecx                 ;Compare EBX and ECX
                jne     cpu_error               ;Error if they're not equal

is386:          mov     ah,09h                  ;Print "Stepping level"
                mov     dx,offset msg
                int     21h
;
; Test for a stepping level of B0 or earlier by executing an XBTS instruction
; and trapping invalid opcode exceptions.
;
                mov     ax,3506h                ;Get interrupt 06h vector
                int     21h                     ;  in ES:BX
                mov     ax,2506h                ;Point interrupt 06h to
                mov     dx,offset invalid_op    ;  internal address
                int     21h
                mov     dx,0                    ;Set DX to 0
                mov     cx,1                    ;Initialize CX for XBTS
                db      0Fh,0A6h,09h            ;Execute XBTS (Step B1 or
                                                ;  later will branch to
                                                ;  label INVALID_OP)
                mov     dx,1                    ;Set DX to 1
invalid_op:     push    ds                      ;Save DS on the stack
                push    dx                      ;Save DX also
                mov     dx,bx                   ;Restore the original
                mov     ax,es                   ;  interrupt 06h vector
                mov     ds,ax
                mov     ax,2506h
                int     21h
                pop     dx                      ;Restore DX and DS
                pop     ds
                or      dx,dx                   ;Branch if DX is still set
                jz      b1                      ;  to 0
                mov     dx,offset stepb0        ;Load DX with message pointer
                jmp     short exit              ;  and exit if it's not
;
; Test for stepping level B1 chips by seeing if ECX is properly decremented
; after a REP INSB instruction followed by a POP.
;
b1:             cld                             ;Clear direction flag
                mov     ax,cs                   ;Point ES:EDI to scratch
                mov     es,ax                   ;  buffer
                mov     edi,offset msg
                mov     dx,80h                  ;Load I/O port address
                mov     ecx,1                   ;Initialize ECX
                push    ax                      ;Push AX onto the stack
                rep     insb                    ;Read string from I/O port
                pop     ax                      ;Pop AX off the stack
                or      ecx,ecx                 ;Branch if ECX is equal to 0
                jz      d0

                mov     dx,offset stepb1        ;Load DX with message pointer
                jmp     short exit              ;Jump to exit
;
; By process of elimination, the chip must be step D0 or higher.
;
d0:             mov     dx,offset stepd0        ;Load DX with message pointer
exit:           mov     ah,09h                  ;Output string identifying
                int     21h                     ;  the stepping level
                mov     ax,4C00h                ;Exit
                int     21h
main            endp

code            ends
                end     begin
```

is not properly set to 0 when a REP INSB instruction (which reads one or more bytes from an I/O port) is immediately followed by a PUSH or a POP. 386STEP looks for the bug by executing the following code sequence:

```
mov  ecx,1
push ax
rep  insb
pop  ax
```

On a D-step 386, ECX will contain 0 at the conclusion of the test and the instructions

```
or   ecx,ecx
jz   d0
```

will result in a jump to the line labeled D0.

On a B1-step 386, however, ECX will not contain 0 and execution will fall through to the next line. In this case, 386STEP stops what it's doing, notifies you that your PC contains a B1-step chip and then terminates. If a branch does occur, the routine concludes that your 386 is a step D0 or higher and informs you of that fact.

386STEP always reports a step level of D0 or higher when run on a 386SX—most of the bugs were worked out of the 386 before the SX came along. In terms of stepping levels, a 386SX is the equivalent of a D-step 386DX.

While it's also possible to identify these chips by the markings on them, the symbols varied somewhat over time. In addition, it's a whole lot simpler to run a short utility than to take the cover off a machine, particularly if you're an IS manager charged with the maintenance of tens or perhaps hundreds of PCs.

386STEP proves especially valuable if your machine frequently locks up when you're running a DOS-extended application or if a 32-bit program simply refuses to run, causing you to suspect an early 386 as the culprit. Using *AutoShade*, Version 2.0, on a B0-step 386, for example, requires that you reconfigure the program by executing its CFIG386 utility with a -B0 switch.

Don't panic if your PC uses a B-step 386. The vast majority of software works fine with these chips, particularly since most is 16 bit and written to run on all members of the Intel 80x86 family.

Don't panic if your PC does use a B-step 386. The vast majority of software works fine with these chips, particularly since most is 16 bit and written to run on all members of the Intel 80*x*86 family. Also, as we mentioned in the earlier Tutor column, some PC manufacturers knowingly used B-step 386s in their products, but built in hardware fixes to compensate for chip errata.

You can obtain a copy of 386STEP.COM from PC MagNet or by typing in the 386STEP.ASM in Figure 1 and assembling it with MASM. If you don't have access to a modem or an assembler, create 386STEP.COM using the DEBUG script shown in Figure 2. As usual, start DEBUG and enter the commands directly or store the commands in a text file and type

```
DEBUG < 386STEP.SCR
```

to run the script automatically.

Incidentally, errata 17 and 21 weren't the only problems uncovered in B-step 386s. Most of the others were reasonably innocuous and unlikely to occur except on rare occasions. One, however, was particularly bad. Some of the B1-step 386s suffered from pattern-sensitive bugs when performing 32-bit multiplies. The condition was seemingly random and aggravated by changes in temperature, clock speed, and power supply voltage. Once

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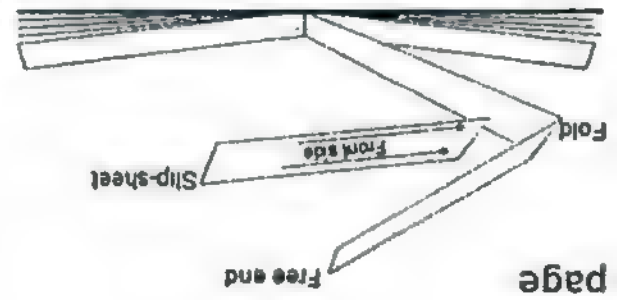

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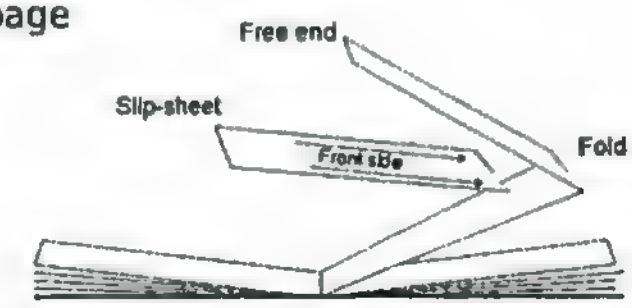

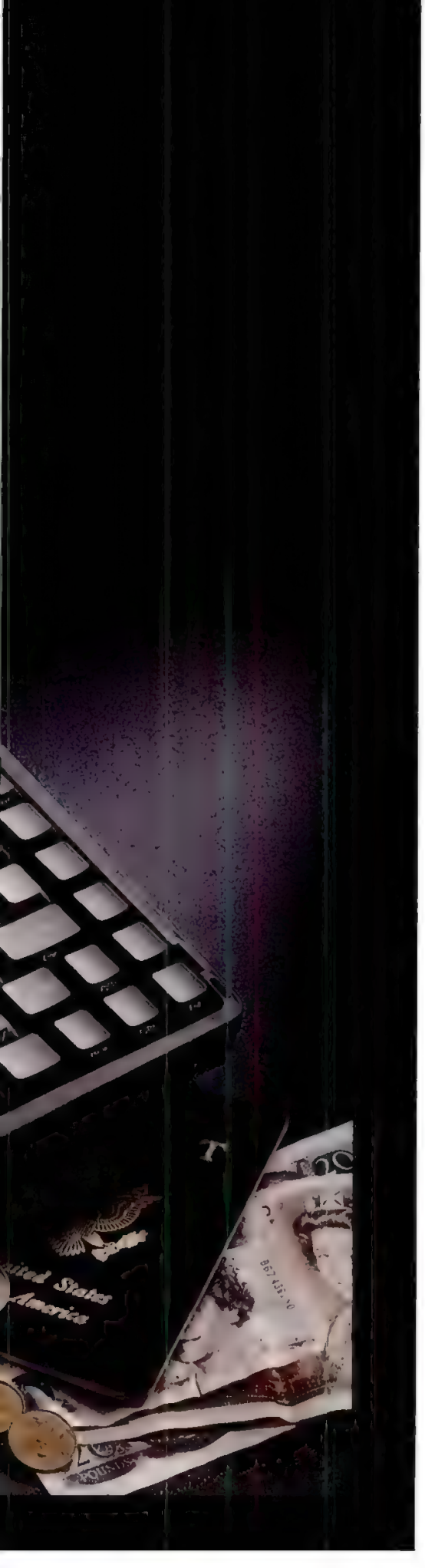

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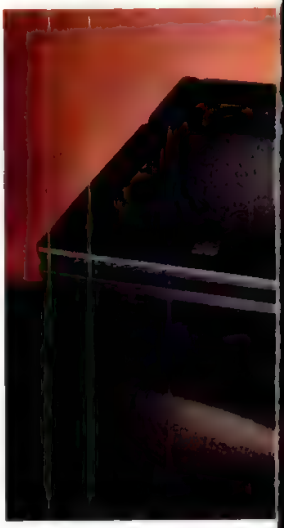

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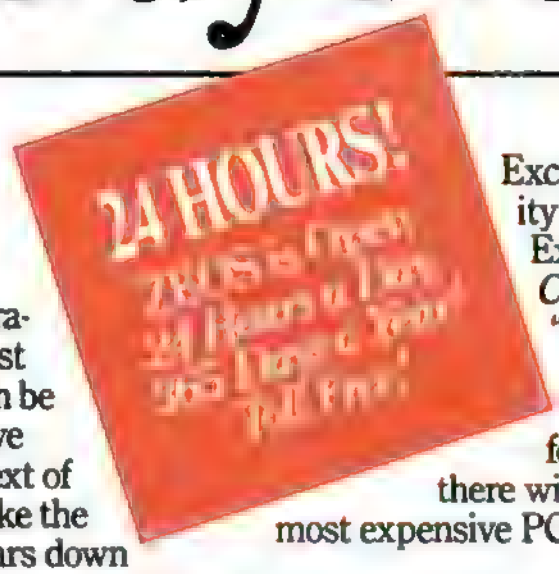

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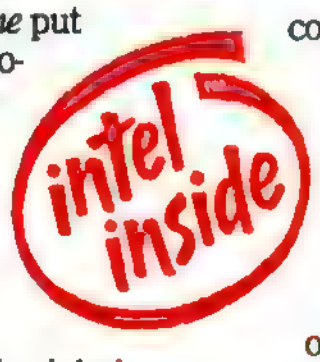

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City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

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Previous Employer _____ From - To _____

Occupation _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income $ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

_____ Relationship _____

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Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	___	_____	Dept. Store Charge Card	___	_____
VISA	___	_____	Credit Union Account	___	_____
MasterCard	___	_____	Other Major Charge Cards	___	_____
Finance Company Loan	___	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence _____ (Mo./Yr.)

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary $ _____

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Date _____

Joint Applicant's Signature _____

Date _____

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386STEP.SCR — COMPLETE LISTING

```
N 386STEP.COM
E 0100 EB 3F 53 74 65 70 70 69
E 0108 6E 67 20 6C 65 76 65 6C
E 0110 20 24 42 30 20 6F 72 20
E 0118 65 61 72 6C 69 65 72 24
E 0120 42 31 24 44 30 20 6F 72
E 0128 20 68 69 67 68 65 72 24
E 0130 45 72 72 6F 72 3A 20 4E
E 0138 6F 74 20 61 20 33 38 36
E 0140 24 9C 58 8B D8 81 E3 00
E 0148 40 35 00 40 50 9D 9C 58
E 0150 8B C8 81 E1 00 40 35 00
E 0158 40 50 9D 3B D9 75 0C B4
E 0160 09 BA 30 01 CD 21 B8 01
E 0168 4C CD 21 66 8B DC 66 83
E 0170 E4 FC 66 9C 66 58 66 8B
E 0178 C8 66 81 E1 00 00 04 00
E 0180 66 35 00 00 04 00 66 50
E 0188 66 9D 66 9C 66 58 66 8B
E 0190 D8 66 81 E3 00 00 04 00
E 0198 66 35 00 00 04 00 66 50
E 01A0 66 9D 66 8B E3 66 3B D9
E 01A8 75 B5 B4 09 BA 02 01 CD
E 01B0 21 B8 06 35 CD 21 B8 06
E 01B8 25 BA CA 01 CD 21 BA 00
E 01C0 00 B9 01 00 0F A6 00 BA
E 01C8 01 00 1E 52 8B D3 8C C8
E 01D0 8E D8 B8 06 25 CD 21 5A
E 01D8 1F 0B D2 0F 84 05 00 BA
E 01E0 12 01 EB 27 FC 8C C8 8E
E 01E8 C0 66 BF 02 01 00 00 BA
E 01F0 80 00 66 B9 01 00 00 00
E 01F8 50 F3 6C 58 66 0B C9 0F
E 0200 84 05 00 BA 20 01 EB 03
E 0208 BA 23 01 B4 09 CD 21 B8
E 0210 00 4C CD 21

RCX
114
W
Q
```

Figure 2: Redirecting this script into DEBUG produces 386STEP.COM, a utility to determine the stepping level of Intel 80386 processors.

Intel became aware of the problem, the company began testing 386s as they came off the production line, stamping bad ones "For Sixteen-Bit Software Only." Those that passed received a distinctive double sigma, one of the identifying marks of a B1-step chip. The problem was corrected in D-step 386s.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. Questions about DOS and systems in general are answered here. Send your question to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see page 10 for instructions). We regret that we cannot acknowledge submissions or answer questions individually. ■

by
Neil J. Rubenking

User-to-User

PAUSING A BATCH FILE

As microprocessors get faster, it is becoming nearly impossible to read the various messages produced by TSRs or other programs when your AUTOEXEC .BAT—or any other batch file—executes. This is not necessarily a bad thing; there are many times when you don't need to see the messages. But sometimes I find myself wanting to slow down or pause the routine at certain points (as when I've just added a new TSR).

My solution to this problem was to write ALTPAUSE, a small (17-byte) .COM program that causes the batch file to pause if any of the Shift keys are pressed. By sprinkling this program liberally throughout the AUTOEXEC.BAT (in my case, right after each TSR), I am able to stop my AUTOEXEC.BAT file at certain points of interest. All I have to do is hold down Alt, Ctrl, or either one of the Shift keys. When ALTPAUSE.COM executes, it just keeps looping until the key is released. During normal boot-ups, the AUTOEXEC.BAT is not significantly impeded.

As an additional benefit, if you use the Ctrl key you can terminate the batch file easily after the pause by typing a "C" before releasing the Ctrl key.

You can create this handy ALTPAUSE program using the DEBUG script shown in Figure 1.

Tom R. Donnelly
San Dimas, California

PAUSING A BATCH FILE: This tiny program inserts an optional pause in your batch files.

The DOS batch file language does contain a PAUSE statement, but a batch file that uses it can't run to completion unless someone is there to press a key. ALTPAUSE.COM provides an *optional* pause; there's no interruption to your batch file unless you request it. That's handy!

As usual, to go from a script of DEBUG commands to a finished program, you redirect the script as input to DEBUG, like so:

```
DEBUG < ALTPAUSE.SCR
```

If you don't see any `^ Error` lines, you've successfully created ALTPAUSE.COM. Be sure to include the blank line just before the line containing RCX.

Figure 2 is a slightly modified version of ALTPAUSE.SCR. This version creates ALTPAUS2.COM, which sets the ERRORLEVEL to 1 if you pause the batch file's operation. Using this modified version, you can choose to execute special batch file lines *only* when you've paused to examine what's going on. For example

```
...
ALTPAUS2
IF NOT ERRORLEVEL GOTO NoPause
MEM
PAUSE
:NoPause
```

ALTPAUSE.COM checks the shift-state byte at address 0040:0017. The lowest four bits of this byte are set to 1 only if the corresponding key (Alt, Ctrl, Left Shift, or Right Shift) is pressed. The assembly instruction TEST compares the shift state byte with the hex number 000F; if any of the four bits is 1, the JNZ statement that follows will jump back to before the TEST statement. As long as any one of the four keys is being pressed, the program will continue looping.

In this case, any time you pause the batch file, you'll also get a report from the MEM command (introduced in DOS 4.0), followed by an actual PAUSE statement that holds the report on-screen until you press a key.

ALTPAUSE.SCR COMPLETE LISTING

```
A100
MOV   AX,40
MOV   DS,AX
TEST  BYTE PTR [17],0F
JNZ   105
MOV   AX,4C00
INT   21

RCX
11
NALTPAUSE.COM
W
Q
```

Figure 1: Redirect this script into DEBUG to produce ALTPAUSE.COM, a program that will pause your batch files *only* if you're holding down a Shift key. The program will continue to execute until the key is released.

ALTPAUS2.SCR COMPLETE LISTING

```
A100
MOV   AX,40
MOV   DS,AX
MOV AL, 0
JMP 10B
MOV AL, 1
TEST  BYTE PTR [17],0F
JNZ   109
MOV   AH,4C
INT   21

RCX
16
NALTPAUS2.COM
W
Q
```

Figure 2: The pause program created by this DEBUG script sets the ERRORLEVEL to 1 if you use it to pause a batch file.

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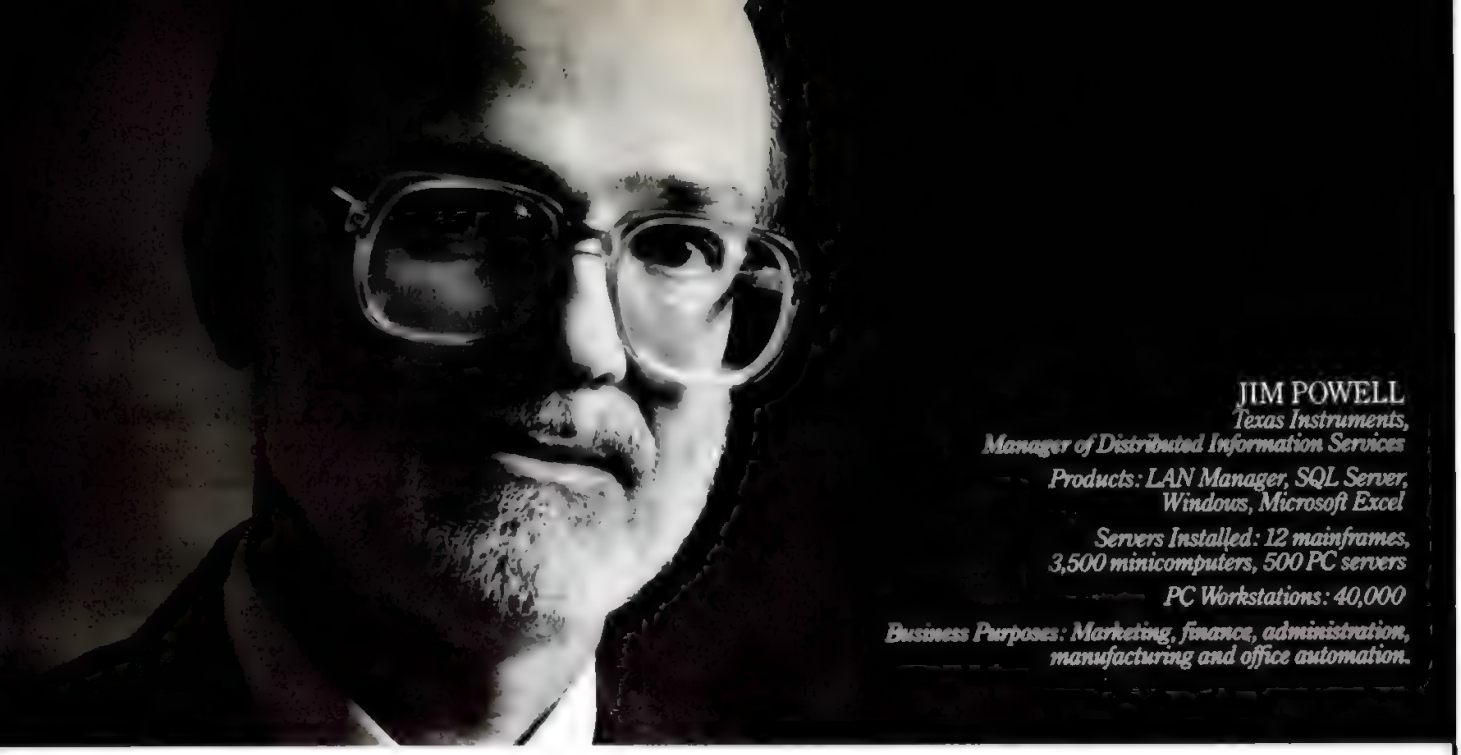

JIM POWELL
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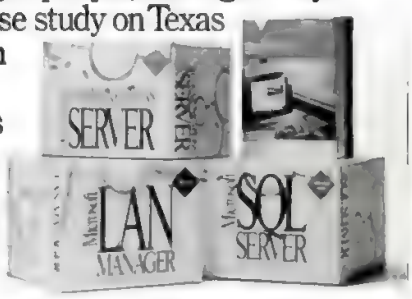

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by
Fran Finnegan

Windows

MANAGING .ZIP FILES

When I download files from bulletin boards (BBSs), the files often come in compressed format, usually as .ZIP files. Consequently, I have to start a DOS shell, and key in a command to unzip these downloaded files. But I have discovered an easier way to unzip the files from within Windows.

Using File Manager, put PKUNZIP.EXE and the downloaded .ZIP file into the same directory. I dedicate a specific "download" directory for this purpose and keep PKUNZIP in it. Click on the zipped file and drag it onto PKUNZIP, and then release it. A dialog box will appear saying "Are you sure you want to start PKUNZIP.EXE using *filename*.ZIP as the initial file?", to which you respond Yes. Windows will automatically start a DOS shell and the .ZIP file will be expanded. When it is finished, you will be returned to the File Manager. Close the window that the .ZIP file is in and then reopen the window to refresh the file listing. All of the unzipped files will be in that directory.

Unfortunately, I have not been as successful trying to zip files from File Manager by dragging a file onto PKZIP.EXE (the DOS program that zips files).

Steve Konings
Milwaukee, Wisconsin

■ MANAGING .ZIP FILES: Using File Manager to zip and unzip files.

The reason that Mr. Konings's tip works so well is that PKUNZIP accepts as its first parameter the name of the file to be unzipped. This is precisely the protocol that Microsoft has established for the *drag and drop* technique. The executables that are drop *targets* (PKUNZIP in this case) are started up and passed the dropped file's name as their first parameter, and the dialog box then asks you to confirm the action. This will work for any DOS program that accepts a filename as its first parameter.

For the uninitiated, PKZIP and PKUNZIP are shareware programs that compress and expand files, respectively. The compression reduces the file's size, usually to save disk space or permit faster transmission of files. Your original Windows disks come with files that have been compressed by Microsoft's Compress program in order to save disk space, and they must be expanded by using the Microsoft Expand program or the Windows Setup program.

While Compress and Expand deal with a single source and destination file, PKZIP and PKUNZIP permit multiple files to be compressed into and expanded from a single .ZIP file, and are therefore very popular. PKZIP and PKUNZIP are available for downloading from most BBSs, including PC MagNet, or directly from PKWARE Inc., 9025 N. Deerwood Dr., Brown Deer, WI 53223; 414-354-8699.

The reason that this drag-and-drop technique does *not* work for PKZIP is that PKZIP requires the name of the file that is to be zipped to be the *second* parameter instead of the first. The first parameter must be the filename of the .ZIP file that will contain the file(s) that you want to compress. Microsoft's drag-and-drop specification can not handle this situation directly. But there is a way to solve this problem: by using a DOS batch file.

In a directory dedicated solely to zipping files, create a .BAT file named TONEWZIP.BAT that consists of the following lines:

```
PKZIP NEW.ZIP %1
PAUSE
```

This presumes that PKZIP can be found on your environment's PATH. The PAUSE is optional; it allows you to see whether the zipping has succeeded.

Now all you have to do is drag and drop the file to be zipped onto the TONEWZIP.BAT file. TONEWZIP will execute PKZIP, which will add the dropped file to the NEW.ZIP file. Once you've added all the files you want to NEW.ZIP, you can give it a more meaningful name and move or copy it to wherever makes sense for you. You need to do this, or else you will just be continually adding files to NEW.ZIP.

In keeping with your desire to stay "within" Windows, I wanted to figure out a way that didn't involve resorting to a DOS batch file. As far as I could determine, there's no way to accomplish this kind of drag and drop just by using a Windows .PIF file, because dragging and dropping overrides the .PIF file's Optional Parameters that would be needed to solve this problem. But I did find a Windows shareware program that does within Windows possibly everything that you might want to do with .ZIP files.

WinZip 2.0 is a Windows application that lets you quickly add, delete, extract, view, and run files that are in a .ZIP file. (It requires that you have PKZIP and PKUNZIP, because these are executed by *WinZip* to do the actual zipping and unzipping.) *WinZip* also supports .ARC files (a compression format that predated .ZIP) and self-extracting .ZIP files. It includes on-line help and an optional interface to virus-scanning software. *WinZip* is available to be downloaded from PC MagNet in UtilForum/Tips Forum in the Windows Section (Library 10), or directly from Nico Mak, P.O. Box 919, Bristol, CT 06011-0919, for $29.

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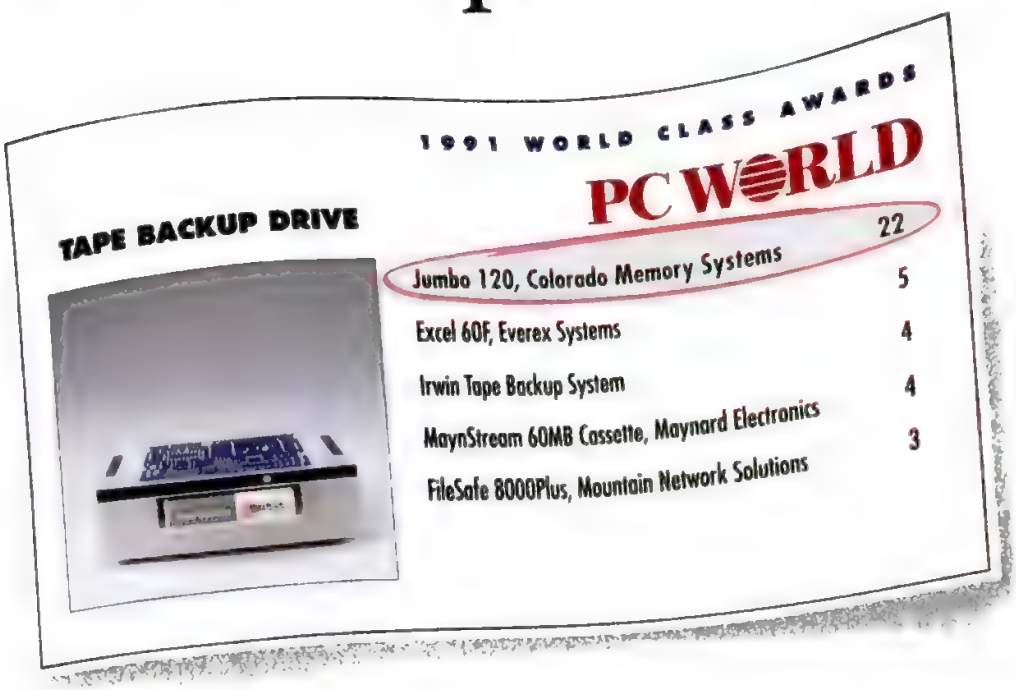

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CIRCLE 026 ON READER SERVICE CARD

by
M. David Stone

The Working Word

LOADING TEMPLATES IN WORDPERFECT MACROS

WordPerfect macros are ideal for simple text that you type repeatedly, such as a company name, but there are some kinds of entries that a macro won't accommodate easily. For instance, if you create a blank form with the line-draw feature, for something like a weekly schedule, and you record the process as you create the form, there is no easy way to edit that macro or add text to it. If you look at the result with the macro editing screen, you won't see a line drawing, but rather a screenful of keystrokes that represent the cursor movements that created the line drawing.

However, there is a way to have a macro retrieve a blank form that you've created and load that form as a document, so you can edit it at will. First, create the form and save it to disk. Then, record a macro to load the form into your standard editing screen.

Press Ctrl-F10 to give the Record Macro command, enter a macro name and description, and then hit Enter to start recording. Give the usual commands for loading a file, hit F5 to list files, enter the drive and directory the form is in, highlight the name of the form, choose Retrieve, and then hit Ctrl-F10 to stop recording.

The macro you've just created will automatically load the file on command so that you can edit it. If you want to change the original file, you can then save it under the same name. If you want to leave the original unchanged, you can save it to a new name. To keep from accidentally overwriting the original when you don't want to, you should get into the habit of saving it to the new name immediately upon loading the file.

Martha Schunk
Gansevoort, New York

PC MAGAZINE There are two distinct issues here: creating a file to serve as a template for other files, and loading that file by way of a macro.

■ LOADING TEMPLATES IN WORDPERFECT MACROS: Modify complex *WordPerfect* forms by calling them up via macros.

Creating a file that serves as a template for other files is particularly well suited to anything that cannot easily be edited in the macro editing screen. In addition to line drawings, this would include any heavily formatted text, such as a heading for letters or memos.

This approach need not be limited to heavily formatted text or complete templates for files. If you like, you can store any text in its own file and load it as needed—even something like a company name that you could store just as easily in a macro.

The major shortcoming of using a separate file rather than a macro for chunks of text is that retrieving a file is generally more cumbersome than running a macro—particularly a macro that you've assigned to an Alt key. However, if you use a macro to retrieve the file, you have effectively erased the distinction between storing the text in a macro versus storing it in a file.

Unfortunately, the macro that Ms. Schunk suggests has some important shortcomings of its own. If you record keystrokes that highlight a particular file and load it, you are also guaranteeing that if the filename changes position on the file list—when you add another file, for example—the macro will load the wrong file.

One way to avoid that is to store all template files in a dedicated template directory and give them arbitrary sequential names—file1, file2, file3, and so on. A better choice is to write the macro so that it loads a specific file.

The macro (in *WordPerfect*, Version 5.0 or 5.1) should take the form

```
{Retrieve}path\filename{Enter}
```

where *path\filename* includes the drive, path, and full name of the file to load. This frees you to use descriptive names for the files without worrying about their position on the file list.

As always, when in the macro editing screen, enter the *WordPerfect* commands shown in curly brackets by pressing the function keys (for commands that correspond to function-key commands), typing Ctrl-V and then the appropriate keystroke (for commands that correspond to keystrokes like Enter), or typing Ctrl-PgUp and then choosing a command from the pop-up list (for macro-specific commands). The commands will show in boldface on the macro editing screen.

Not so incidentally, notice that if you retrieve a file into a blank document editing screen, you will retrieve the original file rather than a copy of it into the current file. You'll then have to be careful not to overwrite the original after you make changes. However, if you have already entered so much as a single space, *WordPerfect* will retrieve the data from disk and add a copy of it to the current editing screen.

You can take good advantage of this distinction between loading a file and retrieving text into a file. Simply add a space or any other character at the beginning of the macro, and a backspace at the end of the macro to delete the character. The macro will now take the form

```
·{Retrieve}path\filename{Enter}
{Backspace}
```

(The dot in mid-line is how *WordPerfect* represents a space in the macro editing screen.)

With this version, you will never load the original file. Even if you start with a blank editing screen, the space will en-

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sure that you retrieve a copy of the text into the current screen instead. On those occasions when you want to change the original file, you can load it like any other file, or you can use this macro and enter the original filename when you save it.

There is one last variation on this scheme that I strongly suggest you consider. If you create lots of templates and boilerplate text files, you will quickly wind up with the same problem that most people have with macros—an inability to remember them all.

However, if you store all the template and text files in a single directory and give them names to match their purpose, you can let *WordPerfect* list the files, and then pick from the list. In that case, you'll want a macro similar to Ms. Schunk's original, except that instead of highlighting and loading a file, it should stop with the file list showing.

The macro will take the form

```
{List}path{Enter}
```

Where *path* includes the drive and full pathname for your template and text files. (In Version 5.0, the command will show as {List Files} rather than {List}.) You can then pick from the list and choose Retrieve. To ensure that you never inadvertently open the original file, you can modify this to read

```
·{List}path{Enter}{Pause}y
{Backspace}
```

(Here again, the dot represents a space.) With this version, you can highlight the appropriate file when the macro pauses, and then hit Enter. The macro will choose Retrieve, answer Yes when *WordPerfect* asks whether to retrieve the file into the current document, and, finally, erase the space it entered at the start of the macro.

TIPS FROM WORKING WORDSMITHS

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by
Craig Stinson

Spreadsheets

UNDOCUMENTED 1-2-3 LABEL PREFIXES

I have discovered two undocumented label prefixes in *Lotus 1-2-3*, Release 2.3 and Release 3.1. Both work only with the Wysiwyg add-in attached.

If you prefix a label with two carets (^^), the label will be centered around the midpoint of its column. If the label is wider than the column, it overflows onto both sides of the column instead of only to the right.

The second new label prefix comes in handy if you want a right-aligned label to overflow to the left of a column. In this case, you can prefix the label with two double quotation marks ("").

Figure 1 shows examples of both these undocumented prefixes in *Lotus 1-2-3*, Release 2.3. Notice that the highlighted label in row 5 is actually stored in cell C3. Because its prefix is ^^, the label is centered on the middle of column C and spills out to both sides of the column. Similarly, the label in row 5 is stored in cell H5. Because it's prefixed with two double quotes (""), it spills out to the left of column H, instead of to the right.

Shane Devenshire
Walnut Creek, California

■ UNDOCUMENTED 1-2-3 LABEL PREFIXES: Two new ways to align your labels in *Lotus 1-2-3*, Releases 2.3 and 3.1.

PC MAGAZINE These alignment options are so useful that it's a pity Lotus chose not to document them. It's possible to conjecture over reasons for their obscurity, though. First, as Mr. Devenshire points out in his letter, they work only with Wysiwyg attached. If you detach the publishing add-in, your labels lose their alignment characteristics and acquire visible prefix characters—extra carets or quotation marks. Second, when it comes time to edit your labels, you might have a hard time finding them. It's not obvious from looking at Figure 1, for example, that the right-aligned label is stored in column H.

But so what? The hazards of using these undocumented label prefixes are trivial, and the benefits considerable.

Wysiwyg also offers a feature that lets you define a range of cells as a text field and then lets you center or right-align labels within that field. You create such fields by choosing :Text Set, and then typing cell coordinates or painting a range with your cursor keys or mouse. Figure 2 shows a pair of labels created with Wysiwyg's text-field feature. Note that when creating labels in a text field, you use the standard label-prefix characters, not the doubled-character prefixes discovered by Mr. Devenshire.

When you want to center a heading between the end points of two columns, you'll find it easiest to define a text field extending from one column to the other. Then type your label, prefixed by a caret, in the left-most column of the defined range. When you want to center a heading over a particular column, however, Mr. Devenshire's double-caret method is simpler and more direct.

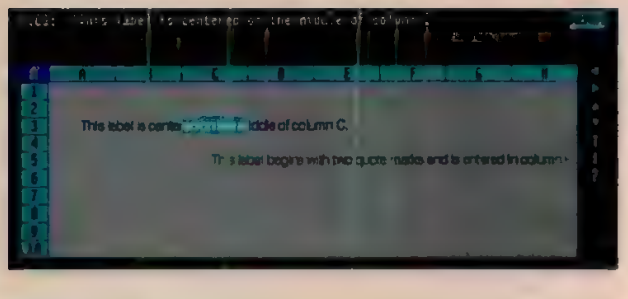

Figure 1: This *Lotus 1-2-3*, Release 2.3, screen shows the effects of two undocumented label prefixes for use with Wysiwyg.

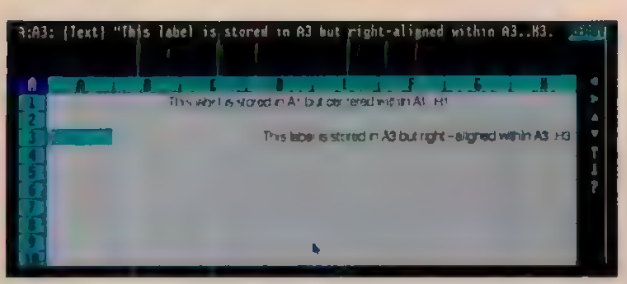

Figure 2: These unusually aligned labels were created with Wysiwyg's text-field feature.

HINTS, TIPS, QUESTIONS

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CIRCLE 367 ON READER SERVICE CARD

by
Frank J. Derfler, Jr.

Connectivity

- **ENHANCED PARALLEL PORTS: New high-speed parallel port technology promises faster throughput.**
- **RESTORING LPT1's ADDRESS: Here's a tiny program that lets you change the address of LPT*x* in the BIOS data area.**

ENHANCED PARALLEL PORTS

Xircom Corp. (the folks who developed the external LAN adapter in 1989) and Zenith Corp. recently announced technology for a high-speed enhanced parallel port (EPP) capable of signaling rates as high as 2MB (16 megabits) per second. Note that parallel port speeds are traditionally listed in bytes per second because the ports move data as complete bytes, but the EPP's effective rate in megabits per second is really impressive.

Hooked to older equipment, EPP hardware works at the typical speed of existing applications and ports, which is 30 to 50 kilobytes per second, but connect one EPP device to another and they can move data at the faster rate. Obviously, Xircom sees higher parallel port speed as critical to eliminating the constriction that chokes external LAN adapters, limiting their practical throughput to well under a megabit per second (of course this depends greatly on the type and speed of the system's CPU).

Zenith announced a commitment to provide EPP throughout its line of portable computers. Importantly, Intel will incorporate the EPP features in its 82360SL I/O subsystem chip for systems based on the company's 386SL CPU. People involved in this development talked about quickly moving from the EPP's 500-nanosecond cycle time to even faster circuitry that could yield signaling rates of 8 megabytes per second. The hardware requires little attention from the CPU or driver software, so the EPP's throughput drops less dramatically than that of today's parallel ports when the computer works at other jobs.

It's easy to predict that companies marketing zero-slot LAN solutions will quickly jump on the EPP bandwagon. As EPP-capable PCs push out older and slower hardware, they'll bring a practical means for linking workgroups, providing them with full networking services over reasonable (although limited) distances at a low cost. The way seems clear to create EPP-connected workgroup subnets of as many as ten PCs—the realistic number determined more by cabling than by throughput—then to link the subnets with faster LAN technology.

Although Xircom helped ignite EPP technology, I see the development headed into a mass of other elements that could rebound in every direction. Certainly, as Xircom is hoping, EPP will enhance the capability of external LAN adapters. But it also has the potential to kill the market for separate internal LAN cards and simultaneously drive vendors to install LAN adapters on PC motherboards. EPP technology might also be the gateway to much less expensive ISDN services for PCs. If networking is important to you, make EPPs one of your considerations for a new computer system—at least to cover your bets for the future.

RESTORING LPT1'S ADDRESS

We installed a network for 100 users with Ethernet cabling and Novell's *NetWare* 3.11. Most of our client PCs are 80286 clones, with printers attached.

But we found that after running the Novell NET*x*.COM program, the locally attached printers were no longer available to our users. We hadn't invoked the *NetWare* CAPTURE program, so the print jobs should not have been redirected, but we still couldn't use the local printers.

After studying the problem, we found that NET*x*.COM changes the address in the BIOS that defines where to send data for LPT1 from the default to 03BCh. All of our parallel boards are configured for the standard LPT1 address of 0378h. So when programs printed to the parallel port through DOS, the BIOS was sending the data to 03BCh and the boards never even saw it.

Our solution was to write a small program in C that restores the old LPT1 address in the BIOS.

```
#include <dos.h>
void main (void)
{
int far *pt;

pt=MK_FP(0,0x408);
*pt=0x378h;
}
```

This program should run after NET*x*.COM but before the LOGIN program.

Ricardo Machado and
Marcelo Albuquerque
Rio De Janeiro, Brazil

PC MAGAZINE This little program pokes the value 0378h into the BIOS data area address 0000:0408h. If you'd like to send your output to LPT2, use the value 040Ah instead.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay you $50 for any tip that we print. Please submit your letter on-disk along with a printout. Then mail your contribution to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016. You may also contact Frank J. Derfler, Jr., via MCI Mail (MCI ID: 240-2931) or the LAN Labs fax machine (904-837-0737). We regret that we're unable to acknowledge submissions or answer letters individually. ■

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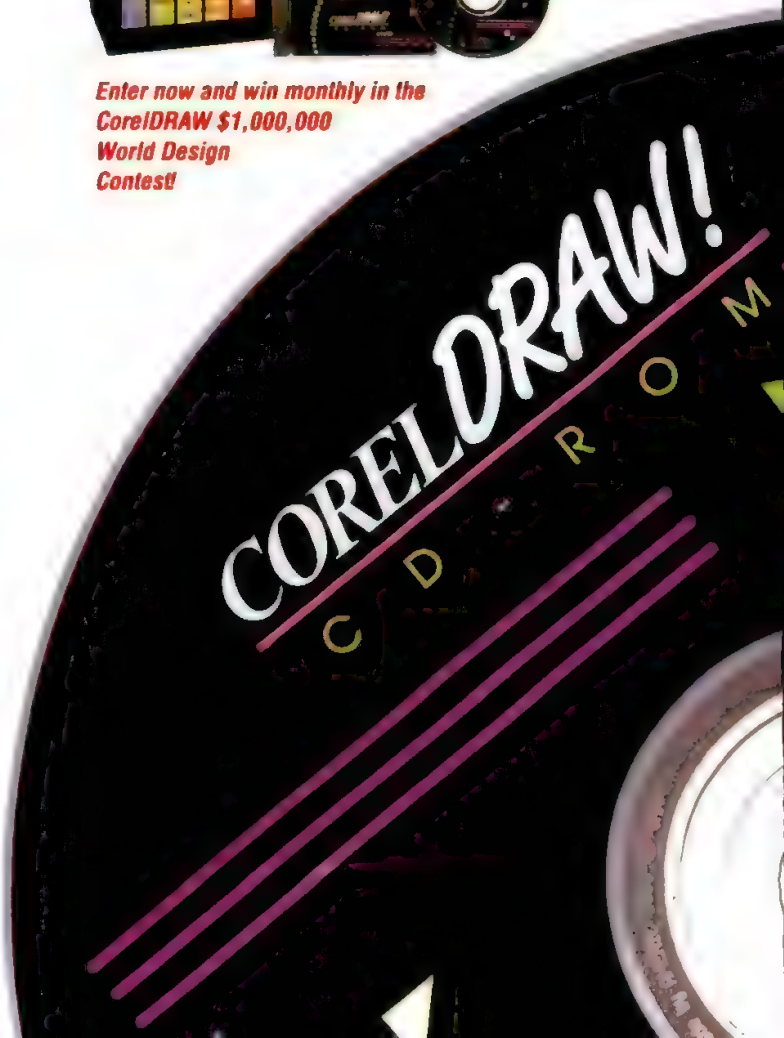

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CIRCLE 177 ON READER SERVICE CARD

by
Ken Hipple

PC MagNet

PC MagNet forums now benefit from CompuServe's new library software. It's called *across-library searching software*. The following is a quick overview of the new features. How the changes affect you will depend on how you access the forums. If you are using a navigation program, you may find you need to upgrade your program to take full advantage of the new features. New versions of *CIM*, *TAPCIS*, and *CISOP* are in the works and probably will have been released by the time you read this. *Autosig* currently emulates the across-library searching feature.

For full information on any of these programs, contact a sysop in the appropriate support forum. The support forums for the programs mentioned are CIS:CIMSUPPORT (CIM), CIS:TAPCIS (TAPCIS), CIS:XTALK (CISOP), and CIS:IBMCOM (Autosig).

The main enhancement is the ability to search for a file across libraries. No more moving from library to library looking for a file. All you do is tell the system which libraries to search, and it does the rest. If you use menus, you will notice a new prompt when you select option 1, BROWSE, of the LIBRARIES menu. The new prompt is

```
Enter libraries (e.g. 1,2,4, or ALL)
or <CR> for the current library
```

If you know which library you want, enter its number or just press Enter for the currently selected one. This is the quickest method, because only one library will be searched. If you aren't sure which library you want, you can search all available libraries by entering ALL, or you can specify which libraries to search. For example, to search libraries 1, 2, 3, and 10, you can enter 1,2,3,10 or 1-3,10.

Command line users can access this feature by using the new LIB: parameter with any directory command. Libraries to be searched are specified as indicated above. LIB:ALL means all available libraries will be searched: LIB:1-3,10 will search libraries 1, 2, 3, and 10. For example, `DIR UMB*.* LIB:0,2` shows the descriptions of all the files in libraries 0 and 2 that start with UMB, and `SCAN *.* KEY:MEMORY LIB:ALL` displays a listing of all files in the forum that have MEMORY as a keyword.

NEW LIBRARY SOFTWARE: The new *across-library searching software* on CompuServe makes it easier to find what you need in PC MagNet.

Note the wildcard characters in the two examples. Since CompuServe filenames are restricted to six-letter names with a three-letter extension, wildcards can come in handy.

File directory information has also been improved. The DIRectory and BROwse commands use an easier-to-understand display format. Here's a sample:

```
[12345,678]      Lib:3
MYFILE.TXT/Asc  Bytes:    1234,
Count:   123,  01-Jan-91(01-Sep-91)
```

[12345,678] is the ID of the person who uploaded the file. Lib: displays when the across-library searching feature is used and indicates which library the file is in. The second line shows the filename followed by the first three letters of the file type. The three types commonly used on ZiffNet are ASCII (7-bit data, text; the only file type that can be viewed on-line), binary, (8-bit data, programs, compressed files), and GIF (Graphic Interchange Format. GIF is a popular graphics format; it supports high-quality color graphics.). Bytes: is the file size. Count: is the number of times this file has been downloaded. The first date is the date the file was originally uploaded, the second is the date the file was last updated (this doesn't appear if the file has never been updated).

You can now move backward as well as forward during a BROWSE. Entering a P, PREV, B, or BACK at the Disposition prompt will display the information for the previous file.

There are two new directory commands: LIST and COUNT. LIST displays a directory listing using one line per file. You could use the command `LIST *.* LIB:ALL` to produce a quick reference listing of all the files in a forum. Before you do that, you might want to use COUNT, which tells you how many files meet your search criteria. Before using a command like `LIST *.* LIB:ALL` you'll probably want to do `COUNT *.* LIB:ALL`. This can save you time and money by letting you know if the search criteria you are about to use are too broad.

The AGE: parameter has been enhanced. Previously this parameter would find files only up to the specified number of days old. Now you can find files older than a given number of days or those that fall in an age range.

Other enhancements include longer file descriptions, the ability to search by file type (TYPE:), and improved help and error messages. Help is available by entering HELP at any prompt.

More information about the new software can be found in the file ACROSS.TXT in Library 1 (General Information) of Utilforum/Tips (GO UTILFORUM) and in the files BROWSE.TXT, NEWLIB.TXT, LIBREF.TXT, and SUMMRY.TXT in Library 3 (New Library Info) of the Practice Forum (GO PRACTICE). Hourly rates (but not communication surcharges) are suspended while you are in the Practice Forum. This gives you a place to try out the new features at a substantially lower cost. If you have any questions, just leave a message in any forum to Sysop, and one of the sysops will be glad to help. ■

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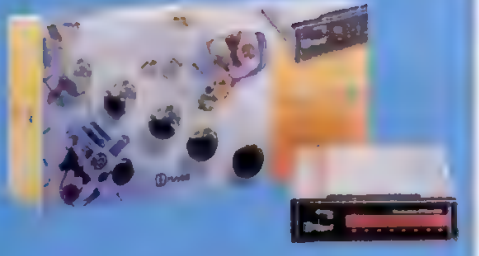

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CIRCLE 239 ON READER SERVICE CARD

by
Douglas Boling

Utilities

Sum the Numbers on Your Screen with ADDIT.COM

It's not a calculator, yet this tiny TSR adds up all the numbers in sight and lets you paste their total anywhere you like.

Unless all your e-mail and memos are neatly formatted and subtotaled by accountants, you've probably often wished that you could quickly and easily add up the numbers you see in the document on your screen. Having to reenter all the figures into a calculator and then transcribe the result is an error-prone nuisance at best.

ADDIT.COM does the job for you. You simply block the on-screen area that contains the relevant numbers, hit the Plus key, and the sum appears. ADDIT ignores the words, reading and summing only the numbers—including negative numbers, if preceded by a minus sign. With another keystroke, you can paste the displayed total either into the same or into another file.

ADDIT.COM is a small TSR (terminate and stay resident) utility (3.5K). While it will pop up over many different types of documents, ADDIT.COM is a DOS program (it requires DOS 3.0 or later). The TSR will come up only in character mode, so it can't capture numbers from the Windows desktop. ADDIT can, however, be run in a DOS session of Windows, or loaded before Windows so that it is available to all DOS sessions.

You can download a ready-to-run copy of ADDIT from PC MagNet, as explained in the sidebar "Downloading Utilities." If your communications software cannot handle executable files, you can download the ASCII file ADDIT.BAS, a BASIC program that will produce the .COM file when you run it. Downloading the additional ADDIT.ZIF file gives you an easy way to modify the default highlight colors and command keystrokes. PC MagNet can also supply the source code listing, ADDIT.ASM. After making any desired changes in the code, you will have to reassemble it with a Microsoft or IBM macro assembler, using the commands

```
MASM ADDIT;
LINK ADDIT;
EXE2BIN ADDIT ADDIT.COM
```

If you don't have a modem, you can request ADDIT.ASM by mail or fax. Just send or fax a postcard with your name and address or fax number to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016. No phone calls, please!

USING ADDIT

The complete syntax for ADDIT is

```
ADDIT [/U] [/B]
```

When entered on the DOS command line or as a line in your AUTOEXEC.BAT file, ADDIT installs itself in memory and waits for you to call upon its services. The /U switch lets you uninstall the program, freeing any memory it used. The only restriction on unloading is that if any additional TSRs were loaded after ADDIT, they must be removed before uninstalling ADDIT.

Use the /B parameter, and ADDIT will use the video BIOS calls instead of writing directly to video memory. While this is much slower than directly writing to video memory, it can come in handy if you have a nonstandard video board that's not CGA or HDA compatible. If ADDIT wrote directly to the display memory of an incompatible adapter, you would see garbage on the screen or your machine might even lock up.

The default hotkey to activate ADDIT is Alt-<Left Shift>. The F1 key brings up a help screen. When you're done with ADDIT, press the Esc key and ADDIT will return to the background to wait for the next time it's needed.

When you pop it up, as is shown in Figure 1, ADDIT presents a one-line banner across the top of the screen and puts its own block cursor at the spot your program cursor occupied. The usual arrow keys move the ADDIT cursor, with the Home and End keys taking it to the beginning and end of the line. The PgUp and PgDn keys take you to the top and bottom of the screen. To block (or highlight) an area on the screen, hold down the Shift key while moving the cursor. Since you will normally want to highlight a number of whole rows, the easiest technique is to go to the top line to be marked and hit the End key. Then, while holding down the Shift key, hit the Down Arrow key as many times as required. The section will then be highlighted. After releasing the Shift key, any subsequent cursor movement will unblock the highlighted area.

To sum the numbers contained in the blocked-off area, simply hit the Plus key. (Either the Plus key on the numeric keypad or on the regular keyboard will do.) ADDIT can handle numbers with up to ten decimal places. The total will be displayed in the ADDIT banner and will be stored in a buffer so you can subsequently paste it anywhere. Positive numbers in

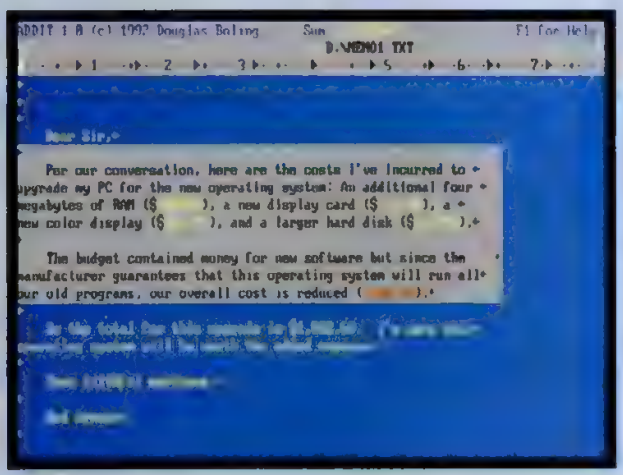

Figure 1: ADDIT.COM is a TSR utility that adds up highlighted numbers in your application. In this screen, the top line is the only ADDIT text.

the highlighted area will show up on color screens in yellow (by default); negative numbers (those preceded by a minus sign) will be displayed in red (by default). This allows you to check that all of the numbers you want (and only the ones you want) included have been added.

Note that if a dash (that is, the minus sign) occurs between two numbers, the second number will be considered negative. But if a dash is the last character on the line and a number begins the succeeding line, the hidden end-of-line marker inserted by some word processors can fool ADDIT into thinking that the number following is positive. Its color will be your clue. How ADDIT distinguishes numbers from other characters is discussed in the sidebar "Teaching ADDIT to Read."

Hitting the P key while ADDIT is active will paste the displayed sum at the cursor location. ADDIT then automatically exits, but it continues to remember the total in its buffer. Thus, you can paste the same sum into several places or documents. If the point where you want to put the result is on a different screen—or in a different document, perhaps requiring you to exit your application and start up another—you first exit ADDIT by hitting the Esc key. Then find the insertion spot you want, bring up ADDIT again by pressing Alt-<Left Shift>, and hit P. You can clear the banner and buffer at any time by starting to highlight a new area.

HOW ADDIT WORKS

The source code for ADDIT can be divided into three parts: the installation routine, the TSR state-save/restore code, and the code that actually does the screen processing and addition. Although the ADDIT source code is well commented, I will discuss each of the three sections briefly.

ADDIT uses the now-standard TSR design method of hooking interrupts, saving the state of the machine, performing its business, restoring the state, and terminating. Fortunately, since ADDIT doesn't access any files or use any other DOS services, the code devoted to saving and restoring the state of the machine can be abbreviated.

When ADDIT is launched, it looks to see whether any copies of itself are already resident. While there are other ways of finding installed copies, ADDIT uses the time-honored method of scanning the system memory control blocks for an exact copy of itself. The only danger with this method is that it might find an image of the program that is actually the data from a DOS buffer or other type of cache. To avoid this, ADDIT modifies the first two bytes of the header before it starts its search. Since the installed copy has also modified *its* header, these two program images will be different from any that may be sitting in a DOS buffer.

If no installed copy is found, ADDIT installs itself. The first job in this process is to find the DOS status flags. As with all well-behaved TSRs, ADDIT uses the DOS InDOS and ErrorMode flags to ensure that it will not pop up at an inopportune time. In the past, finding these flags was a chore. With the release of DOS 5.0, however, Microsoft has finally documented

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Set your communications software to 300, 1,200, or 2,400 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex.

Dial the local number. When you connect, hit Ctrl-C. At the HOST NAME prompt, type CIS. At the USER ID prompt, type 177000,5000. Then, at the PASSWORD prompt, type PC*MAGNET. At the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

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PC MagNet costs $12.80 an hour for 1,200- or 2,400-bps service, or $6.30 an hour for 300-bps service. Billing is based on 1-minute increments. ■

TEACHING ADDIT TO READ

One of the more interesting aspects of ADDIT is how it finds and interprets the numbers on the screen. When the Plus key is pressed, ADDIT searches the area blocked off by the user, starting in the upper-left corner. Each character is read directly from the display memory and is processed according to the set of rules listed below.

1. There are five types of screen characters: a digit (0-9), the period, the dash or minus sign, the comma, and all other characters. The period, dash, and comma are considered special characters.

2. If the character is not a digit or a special character, and if the character immediately preceding was not a digit, the character is ignored and the sign and decimal flags are cleared.

3. If the character is a digit, the current number is multiplied by 10 and the digit is added to the current number. If the decimal flag is set, the exponent is incremented. The character on the screen is highlighted in color. If this is the first digit and if either the sign or the decimal flag is set, the previous character is also colored. If this is the first digit and if both the sign and decimal flags are set, the two previous characters are highlighted.

4. If the character is not a digit, but the character preceding it was a digit, the current number is added to the sum and the current number is cleared. The decimal and sign flags are also cleared.

5. If the character is a period, and the decimal flag is clear, the decimal flag is set.

6. If the character is a period, and the decimal flag is set, the current number is terminated according to rule 4.

7. If the character is a dash, and the character preceding it was not a digit, the sign flag is set.

8. If the character is a dash, and the previous character was a digit, the current number is terminated according to rule 4. The sign flag is then set.

9. If the character is a comma, the previous character was a digit, and if the decimal flag is not set, the character is highlighted.

10. If the character is a comma, the previous character was a digit, and the decimal flag is set, the character is treated as a nondigit character using the process in rule 4.

11. If the character is a comma and the previous character was not a digit, the character is ignored.

12. When the right edge of the blocked off area is reached, the current number is terminated using the process in rule 4.

While these rules seem complicated and repetitious to us humans, they're child's play for a computer. The rules are carried out by ADDIT using a set of routines that implement each of the rules. The routines to be called depend simply on the current character and its proceeding character. A jump table is used to call the proper routine. The index into the jump table is computed according to the current and previous characters.

—Douglas Boling ■

methods for locating both flags.

Finding the InDOS flag is a simple matter of calling the previously undocumented function 34h in DOS. This function, now formally documented in the *Microsoft MS-DOS Programmer's Reference* for Version 5.0, has actually been available since DOS 2.0. The Get InDOS Pointer function returns a pointer to the InDOS flag in ES:BX.

Finding the ErrorMode flag, sometimes called the Critical Error flag, is a little more difficult. Unlike the InDOS flag, there is no function that returns a pointer to it. The still-undocumented function Get DOS Swappable Area (function 5D06h), available since DOS 3.1, returns a pointer to an area that contains the DOS kernel data area including the ErrorMode flag. Since the ErrorMode flag is the first byte in this data area, many programmers have long used this function to get the address of the ErrorMode flag.

The *Programmer's Reference*, however, states that the ErrorMode flag is in the byte immediately preceding the InDOS flag. Actually, it has been sitting in that byte since DOS 3.1. This makes it easier to find the ErrorMode flag simply by using the InDOS pointer.

The only reliable way to find the ErrorMode flag in versions of DOS before 3.1, however, is to scan the DOS kernel for the first occurrence of a combination of machine instructions that point to the address of the ErrorMode flag. ADDIT uses this method for finding the ErrorMode flag in order to be compatible with earlier versions of DOS.

Figure 2 shows the code used to locate the ErrorMode flag. The code uses DOS function 34h to get a pointer to the InDOS flag. If the DOS version is 3.1 or later, the pointer is decremented and the routine terminates. If it is earlier than 3.1, the routine scans the DOS kernel segment for the correct sequence of opcodes. When found, the CMP opcode contains the offset of the ErrorMode flag.

To complete its installation, ADDIT hooks into a number of interrupts. The BIOS interrupts for video (10h), disk (13h), and keyboard (16h) are hooked so that ADDIT can monitor when those interrupts are called. The keyboard hardware interrupt (09h) is hooked to check for the hotkey combination. The Timer (08h) and DOS Idle interrupts (28h) are hooked to monitor the system. The installation routine ends with ADDIT performing a TSR call (function 31h) to DOS.

Once installed, ADDIT's keyboard interrupt routine monitors the keys as they are pressed. When a key is pressed, ADDIT checks the Shift key state. If the Left Shift and Alt keys are pressed simultaneously, the interrupt routine sets a flag to indicate that ADDIT should pop up.

ADDIT's Timer and DOS Idle routines monitor the pop-up flag set by the keyboard interrupt. When this flag is not zero, ADDIT checks the state of DOS to determine whether it is permissible to pop up. ADDIT pops up if the system is not in a BIOS video, disk, or keyboard call and if the ErrorMode flag is not set. If the flag is set, the Timer interrupt routine checks the state; the InDOS flag is also checked to determine whether DOS is processing a call. If none of these conditions exist, ADDIT calls the installed code contained in the MAIN routine.

MAIN first switches ADDIT to an internal stack to avoid overflowing the application program's stack. The processor registers are then saved on ADDIT's internal stack. Next, MAIN checks to ensure

GETCEFPRT

```
;---------------------------------------------------------------------------
; GETCEFPtr Returns a pointer to the DOS ErrorMode flag
; Exit:    CF - Clear if ErrorMode Flag found
;       ES:BX - Segment:offset of ErrorMode flag
;
;  For versions of DOS before 3.1, search for following code in DOS seg
;
;  36: 80 3E ???? 00     cmp  byte ptr ss:[ErrorMode],0
;  75 ??                 jne  near label
;  CD 28                 int  28h
;
;  For DOS 3.1 and later, ErrorMode sits before InDOS flag
;
;---------------------------------------------------------------------------
find_cefptr     proc    near
          cld                             ;String operations UP
          mov     ah,34h                  ;Get ptr to INDOS
          int     21h                     ;After DOS 3.1, the CEF is
          dec     bx                      ;  documented to be the byte
          cmp     dos_version,30ah        ;  before the INDOS flag
          jnc     find_cef_exit

          mov     ax,3e80h                ;CMP Opcode
          mov     si,028cdh               ;Int 28 Opcode
          mov     dl,75h                  ;JNE Opcode
          mov     cx,-1                   ;Max segment size
          mov     di,bx                   ;Start at INDOS address
find_cef_1:
          repne   scasb                   ;Scan for CMP
          jcxz    find_cef_notfound       ;Error if CMP not found
          cmp     es:[di],ah              ;Check other half of CMP opcode
          jne     find_cef_1
          cmp     byte ptr es:[di+4],dl   ;Check for JNE
          jne     find_cef_1
          cmp     word ptr es:[di+6],si   ; Check for Int 28h call
          jne     find_cef_1              ;Resume loop if not found
find_cef_found:
          inc     di
          mov     bx,es:[di]              ;Get offset of ErrorMode flag
          clc
find_cef_exit:
          ret
find_cef_notfound:
          stc
          jmp     short find_cef_exit
find_cefptr     endp
```

Figure 2: This code fragment shows how to locate the ErrorMode flag whether you're using a version of DOS earlier or later than 3.1.

that the current video mode is one of the character-based modes. If not, ADDIT restores the registers, switches back to the application stack, and terminates. If the display is in text mode, the address of the active CRT control register is checked to determine whether the video is in color or monochrome. The attributes for the banner, as well as the various box and number attributes are then set accordingly. To cut down on memory usage, the attribute information is run-length encoded before being saved in ADDIT's internal memory buffer. For more on RLE, see the sidebar "Saving Memory Using RLE."

Since ADDIT makes no calls to DOS while active, none of the DOS state variables such as the active PSP and active DTA need to be changed. Keeping ADDIT simple avoids the code necessary to save and restore the state of these variables.

Before drawing the banner, the characters and attributes on the top line of the screen are saved into an internal buffer. The banner is then drawn and the cursor displayed. The remainder of ADDIT's installed code deals with drawing ADDIT's cursor, waiting for and then responding to keystrokes from the user.

ADDIT's cursor marks the starting point for the defined area within which the user includes the numbers he wants totaled. Indeed, the cursor and ADDIT's highlight box are created using the same process. ADDIT keeps two sets of row/column coordinates to mark the upper-left and lower-right corners of the box. If the two sets are equal, the defined area reduces to a one-character box that becomes the ADDIT cursor.

The DRAWMARKED routine is responsible for drawing both the cursor and the highlighted area on the screen. DRAWMARKED draws the area by changing the attributes of the characters within it. The old attributes are saved so they can be restored when the box is moved or when ADDIT terminates. Before highlighting a new area, DRAWMARKED first determines the size and position of any previously defined area and restores its attributes.

While waiting for keystrokes, ADDIT performs two very important functions. First, it calls the DOS Idle interrupt (28h). This allows other TSRs to monitor the load on the system and, if necessary, operate in the background. Some TSRs (such as DOS's PRINT and *PC Magazine*'s BCOPY) actually monitor the frequency of the Idle interrupt to determine how much time can be used by the TSR without disturbing the user.

Aside from the DOS Idle interrupt, ADDIT also calls the Multiplex interrupt (2Fh) with AX=1680h. This call is the Release Timeslice call for OS/2 and for Windows' Enhanced mode. When OS/2 or Enhanced-mode Windows detect this call, they check to see whether any other program outside of the DOS session needs to run. Using this call can improve the performance of a system running OS/2 or Windows.

Figure 3 shows the GetKey routine that ADDIT uses to query the keyboard. Note that the routine does not merely call the BIOS Keyboard Read function, since this function does not return until a key is pressed. The GetKey routine calls the Keyboard Status routine to determine whether a key is available. If a key is not available, GetKey calls the DOS Idle interrupt (INT 28), then it calls the Multiplex interrupt with AX=1680h, the Windows-OS/2 Release Timeslice function. If a key is available, the routine calls the BIOS Keyboard Read routine to get the key from the keyboard buffer.

When a key is pressed, ADDIT compares the scan code with a list of acceptable scan codes. If the code isn't in the list, the key is ignored, and ADDIT waits for another key. If the scan code is in the list, ADDIT uses the offset into the list of the matching scan code as an index into a jump table of the key-processing routines. The appropriate routine is then called and ADDIT loops back to read another key.

GETKEY

```
;-------------------------------------------------------------------
; GETKEY  Waits for a key from the keyboard.
; Exit:   AX - Scan code, ASCII char from keyboard.
;-------------------------------------------------------------------
getkey          proc    near
          mov     ah,1                    ;BIOS Keyboard Status
          int     16h
          jnz     getkey_exit
          int     28h                     ;Call DOS Idle
          mov     ax,1680h                ;Release Timeslice
          int     2fh
          jmp     short getkey
getkey_exit:
          xor     ax,ax                   ;BIOS Keyboard Read
          int     16h
          ret
getkey          endp
```

Figure 3: ADDIT uses this GetKey routine to call the Keyboard Status routine to determine whether a key is available.

The cursor key routines update the two sets of coordinates. For example, if the user presses the Down Arrow key, ADDIT checks to see if the row coordinate is already on the bottom row. If not, ADDIT increments the row count of one of the sets of coordinates. ADDIT then checks to see if either of the Shift keys is pressed. If not, the second set of coordinates is set to match the first, creating the single character cursor. If the Shift key is pressed, the second set of coordinates is not updated. DRAWMARKED is called to update the boxed area on-screen.

Aside from the cursor keys, ADDIT checks for the F1 key, the Plus key, the P key, and the Esc key. The F1 key routine saves the contents of the first few lines on the screen and displays the help message. When the user next hits any key, the routine restores the original contents of the screen, thus replacing the help message.

The ADDMARKED routine is called when the user presses the Plus key. This routine scans the marked area on the screen for numbers, adds the numbers, and sets the sum. The characters in the box are processed according to a set of rules that define how numbers are recognized. These rules are detailed in the sidebar "Teaching ADDIT to Read."

Pressing P causes ADDIT to copy the current sum into the system's BIOS keyboard buffer. The sum cannot be *copied* into the buffer, however, since the keyboard buffer must contain both the ASCII character and the keyboard scan code for that character. Thus ADDIT's GETSCAN routine appends the proper scan code for each ASCII character in the sum. The values are placed in the keyboard buffer and ADDIT terminates as if the Esc key had been pressed. The application simply reads the keys in the buffer as if the user

SAVING MEMORY USING RLE

ADDIT's stock in trade is capturing numbers off the screen. Therefore, it had to be compatible with as many screen modes as possible. ADDIT can work with screen sizes up to 132 by 60 characters and even larger. The problem with giving ADDIT this flexibility is the amount of memory it takes to save a large screen.

Usually, TSR programming practice dictates that you simply copy the contents of the screen memory into a buffer so that the screen can be restored when the TSR terminates. However, saving a 132-by-60 screen often takes close to 16K of memory just for the screen buffer! Even with today's memory managers, such as *QEMM*-386, *386MAX*, and DOS 5.0's EMM386, 16K seemed completely unacceptable; TSRs should always strive to consume as little memory as possible. Therefore, I designed ADDIT to compress the data from the screen buffer before saving it into its memory buffer.

When ADDIT pops up, it reads the entire screen memory to get the attributes for each character on the screen. The attribute information is then run-length encoded before it is saved in ADDIT's internal memory buffer. By run-length encoding the attribute information, ADDIT reduces its screen-save buffer size from 16K to 1,024 bytes.

Run-length encoding reduces the size of the data by reducing a series of identical bytes of information into a count of the bytes and a byte containing the data for the series. The example below shows how the data is encoded. Here, a 20-byte series

```
17 17 17 15 10 10 10 10 10
10 10 80 80 9 9 9 9 9 9 9
```

is reduced to blocks of

```
3-17  1-15  7-10  2-80  7-9
```

which is stored as 10 bytes:

```
3 17 1 15 7 10 2 80 8 9
```

If the attribute bytes on the top line of an 80-column screen were stored in uncompressed form, the result would be 80 bytes in a screen buffer. If the attribute bytes were run-length encoded, the 80 bytes could be reduced to as little as just 2 bytes. ADDIT takes advantage of the fact that most screens use the same attribute for the majority of characters that are on the screen. The disadvantage of this approach is that if the attributes on the screen change for every single character, the resulting encoded list would be twice as long as simply storing the attributes unencoded.

ADDIT's screen buffer is 1,024 bytes, large enough to hold all but the most complex of multicolored screens. If the screen is so complex that the buffer limit is exceeded, ADDIT uses the buffer that normally stores the screen contents under the help message to save the attributes. Using this buffer disables the help message, but allows ADDIT to perform its job.

—Douglas Boling ■

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had typed them at the keyboard.

The Esc key causes ADDIT to restore the screen, switch to the application's stack, and return. The application receives control without ever knowing that ADDIT has been popped up.

ADDIT MATH

Since ADDIT's forte is addition, a brief discussion of how it adds numbers is appropriate. The microprocessors in the 80*x*86 family have a special addition instruction, but in the 8086 and 80286 these instructions are limited to 16-bit operations. This means that the largest number ADDIT could handle would be ±32,768, which is unacceptably low. Fortunately, using the Add with Carry (ADC) instruction easily extends additions beyond 16 bits.

If ADDIT had been designed to use 32 bits to represent each number, the maximum values would have been ±2,147,483,648. While this would probably have been adequate to allow ADDIT to handle even larger numbers, I decided to use a 48-bit representation. This allows for numbers up to ±140,737,488,355,327, which should handle everything but the federal budget deficit. ADDIT uses an 8-bit exponent to keep track of the decimal point, bringing the size of a number to 56 bits, or 7 bytes. ADDIT keeps two of these numbers, one for the number being read from the screen (called the *current number*) and another for the sum of the numbers (called the *sum number*). One other byte, the *sign flag*, is used to indicate that the current number was preceded by a dash (-), indicating that it should be converted into a negative number.

As a digit is read off the screen, the value in the current number is multiplied by 10; then the new digit is added. This continues until a nonnumeric character is found. If a decimal point is found, the exponent is incremented for each digit found right of the decimal. Once the number has been read in, the sign flag determines whether the number should be two's complemented.

If not for the exponent, the numbers could be added using the ADD instruction followed by two ADC instructions. In fact, if the two exponents are equal, the addition *is* carried out by successively loading a word from the current number into AX, then adding it with the ADD and ADC instructions into the sum number.

The exponent flag complicates matters slightly. When two numbers are added, the exponents are compared. If equal, the numbers are added as we discussed above. If the exponents are not equal, the number with the lower exponent is multiplied by 10 the number of times that is the difference between the two exponents. For example, if the current number has an exponent of 2 and the sum has an exponent of 5, the current number would be multiplied by 10 three times so that its exponent matches the exponent of the sum. Once the exponents match, the numbers are added.

ADDIT is one of those cute little utilities that is both fun and useful. While it doesn't have the flash of a Windows program, the speed of an OS/2 program, or the versatility of a full-fledged calculator, for pure usefulness in a small TSR, ADDIT can still hold its head high. ■

Douglas Boling is a contributing editor of PC Magazine.

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CIRCLE 340 ON READER SERVICE CARD

by
Andrew Schulman

Lab Notes

Undocumented Functions in Windows, Part 2

■ In this second and concluding part, you'll explore how to safely use the same undocumented Windows functions used by Microsoft's own shell programs, development tools, languages, and commercial programs.

In last issue's Lab Notes we began to explore the underworld of the Windows API: important programming functions that are documented neither in Microsoft's *Programmer's Reference* nor in the Software Development Kit (SDK) header file, WINDOWS.H. We saw how dynamic linking in Windows, based on the NE executable file format, makes it easy to find these functions without disassembling a line of code. Just by using Phar Lap's MAPWIN utility, available on PC MagNet, you can produce a fairly complete listing of Windows API functions and variables used by any executable file, DLL, or 16-bit *.DRV device driver.

I say "fairly complete" because Windows also allows a program to link in functions *while running*, via the documented GetProcAddress() API call. Any program that imports this function can use additional undocumented functions whose names won't turn up in the MAPWIN output. To find such calls you do need to disassemble the program, using one of the Windows spelunking tools that have recently become available. One of these is the amazing debugger Soft-ICE for Windows, which is available from NuMega Technology. Another is Windows Sourcer, a "processor" I have written for V Communications.

Last time, in examining the Norton Backup for Windows file (NBWIN.EXE) from *The Norton Desktop for Windows*, we found a number of undocumented Windows functions, including GetHeapSpaces(), SetSelectorBase, and GetSelectorBase(), plus an undocumented memory selector, __0040H. We also saw that, like all Windows applications, NBWIN uses three barely documented functions: InitApp(), InitTask(), and WaitEvent(). These three functions, a necessary part of a Windows application's start-up code, have only recently been documented by Microsoft—at least to a select audience of independent software vendors (ISVs)—as part of its welcome "Open Tools" strategy.

In this second, concluding part we'll extend our search for undocumented API functions to additional *NDW* files. Using *NDW* is simply illustrative; other commercial Windows applications also use undocumented calls. We'll go on to look at Microsoft's shell programs, its Windows development tools, its commercial applications (for example, *Excel*), and its languages (such as Visual Basic (VB) and Quick C for Windows (QC/W)). All of these use undocumented calls, as well.

Many programmers think it wrong—or at least "bad engineering"—for software to employ undocumented functions. As we continue, however, you'll see that the world of Windows requires them, for it is just as unruly as the Wild, Wild West of MS-DOS. Toward the end of this article, I'll take up the question of whether it is *safe* to use undocumented functions and, finally, *how* to use them in a relatively safe manner.

Of course, the main reason why any system contains undocumented functions is for its own internal use. In Windows, one DLL (dynamic link library) generally exports undocumented functions for use by other DLLs. In some cases—such as the sacrilegiously titled Death() and Resurrection() functions exported by the Windows GDI module for the USER module—these are private interfaces used only by Windows. Even so, exploring such functions can deepen your understanding of how Windows works. Along the way, you'll also get some amusing insights into the attitudes of Microsoft's programmers, as in the case of the USER function called TabTheTextOutForWimps(). Even if an ad hoc function (the Enhanced mode DOS box uses the WinOldAppHackOMatic()) it may play a useful part in your own Windows programming. After all, if someone at Microsoft needed that function, chances are someone outside Redmond could probably use it too. As we go to press, it appears Microsoft is making an effort to document some of these functions in Windows 3.1 SDK.

DEEPER INSIDE THE NORTON DESKTOP

If you run MAPWIN on every program and DLL that comes with *NDW*, you'll come up with the eight functions and two selectors listed in Figure 1. I discussed __0000H, __0040H, GetHeapSpaces, and the Get/SetSelectorBase/Limit family sufficiently last time, though later I'll discuss some version differences in their implementation. Let's look at the other undocumented functions shown in Figure 1.

- Get/SetInternalWindowPos. These two undocumented USER functions can be used to get and set the restored size and show the state of an iconic window, to get

UNDOCUMENTED WINDOWS FUNCTIONS AND SELECTORS USED IN NDW

```
__0000H (KERNEL.183)
    SIW.EXE (System Information for Windows)

__0040H (KERNEL.193)
    SIW.EXE
    NDLL.DLL
    NBWIN.EXE

GETHEAPSPACES (KERNEL.138)
    NBWIN.EXE (Norton Backup for Windows)
    NWIN.DLL

GETINTERNALWINDOWPOS (USER.460)
    SFIND.EXE (Super Find)
    SCHEDULE.EXE
    NDWDLL.DLL
    NWIN.DLL

GETSELECTORBASE (KERNEL.186)
    NBWIN.EXE
    NDLL.DLL

GLOBALMASTERHANDLE (KERNEL.28)
    SIW.EXE

SETDESKWALLPAPER (USER.285)
    BATCHRUN.EXE

SETINTERNALWINDOWPOS (USER.461)
    SMTERASE.EXE (Smart Erase)
    NVIEWER.EXE (Norton Viewer)
    SCHEDULE.EXE
    NDWDLL.DLL
    NWIN.DLL

SETSELECTORBASE (KERNEL.187)
    NBWIN.EXE
    NDLL.DLL

SETSELECTORLIMIT (KERNEL.189)
    NDLL.DLL
```

Figure 1: A list of the undocumented Windows functions and selectors used by *The Norton Desktop for Windows* as revealed by the MAPWIN utility.

SETDESKWALLPAPER()

```
extern BOOL FAR PASCAL SetDeskWallPaper(LPSTR lpszBmpFilename);

char *lpszBmpFilename;
// ...

if (SetDeskWallPaper(argv[1]))
    InvalidateRect(GetDesktopWindow(), NULL, TRUE);
```

Figure 2: A sample use of the undocumented SetDeskWallPaper() function.

and set the icon location for a non-iconic window, and to get the *park point* (*where* a window would be moved if it were iconized) when a window is not iconized. For example, suppose you need to know where a window that is currently iconized will be restored. You could write

```
RECT rcRestore;
POINT ptPark;
GetInternalWindowPos(hWnd,
  &rcRestore, &ptPark);
```

Similarly, to *set* the place at which a currently iconized window will be restored, you can use SetInternalWindowPos:

```
RECT rcNewRestorePosition;
// ...
SetInternalWindowPos(hwnd,
    SW_SHOWMINIMIZED,
    &rcNewRestorePosition, NULL);
```

■ GlobalMasterHandle(). This function is used by SIW to produce its Windows Memory Display. The function returns a selector to the master block of the Windows global heap, which is a linked list. Using selectors kept in this master block you can walk through all the Windows memory blocks, counting up the amount of memory being used by an application, for example. Not surprisingly, the GlobalMasterHandle() function is used by most applications that display Windows memory, including Heapwalk from the Microsoft Windows SDK and hDC's Memory Viewer.

Using the undocumented GlobalMasterHandle() call is no longer necessary, however. Documented functions and data structures in Microsoft's TOOLHELP.DLL, which is available with the 3.1 SDK but which also works under Windows 3.0, can now be used in applications that display Windows memory. Because it does not require an additional DLL, however, use of GlobalMasterHandle() is unfortunately likely to persist until Windows 3.1 is more firmly established than Version 3.0.

■ SetDeskWallPaper(). This undocumented USER function is used as part of the WallPaper() function in the *NDW* batch language. As its name implies, it provides programmatic access to the Windows desktop wallpaper. A code fragment illustrating its use appears in Figure 2. Note that this function does not automatically repaint the Windows desktop; for that, you must call InvalidateRect(). Moreover, the call does not preserve your new wallpaper setting in WIN.INI. To do so, you would also call WriteProfileString().

In addition to using a number of undocumented Windows functions, *NDW* embodies some slick programming tricks. For example, *NDW* is a heavy user of the DPMI (DOS Protected Mode Interface), making DPMI INT 31h calls to generate real-mode INT 13h (BIOS disk services) calls. Note that the Soft-ICE for Windows BPINT (breakpoint on interrupt) command can be used to find which INT 31h calls a Windows program makes.

In exploring *NDW*, then, we've looked at an important Windows application that makes heavy use of undocumented Windows functions. This makes sense, considering what *NDW* does, and considering that it aims to replace programs that many users mistakenly think of as built-in parts of Windows. Despite what we've found in *NDW*, however, it's important to note that there are many equally clever Windows applications that use *no* undocumented Windows functions.

UNDOCUMENTED FUNCTIONS USED IN MICROSOFT'S SHELL SOFTWARE

```
CALCCHILDSCROLL (USER.462)
    PROGMAN.EXE

CASCADECHILDWINDOWS (USER.198)
    TASKMAN.EXE

CONTROLPANELINFO (USER.273)
    \WIN30\CONTROL.EXE

CREATECURSORICONINDIRECT (USER.408)
    \WIN30\PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL

DELETEPATHNAME (KERNEL.76)
    PRINTMAN.EXE

DIRECTRESALLOC (KERNEL.168)
    PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL
    WINHELP.EXE

DRAGOBJECT (USER.464)
    PROGMAN.EXE
    WINFILE.EXE

DUMPICON (USER.459)
    PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL

FILECDR (KERNEL.130)
    WINFILE.EXE

GETCURPID (KERNEL.157)
    \WIN30\PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL
    WINFILE.EXE
    MSDOS.EXE
    \WIN30\PIFEDIT.EXE

GETHEAPSPACES (KERNEL.138)
    \WIN30\PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL
    \WIN30\WINFILE.EXE
    MSDOS.EXE

GETICONID (USER.455)
    \WIN30\PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL

GETINTERNALWINDOWPOS (USER.460)
    PROGMAN.EXE
    \WIN31\WINFILE.EXE

GETLASTDISKCHANGE (KERNEL.98)
    MSDOS.EXE

GETSPOOLJOB (GDI.245)
    CONTROL.EXE
    PRINTMAN.EXE

GLOBALMASTERHANDLE (KERNEL.28)
    MSDOS.EXE

ISWINOLDAPTASK (KERNEL.158)
    TASKMAN.EXE

LOADICONHANDLER (USER.456)
    \WIN30\PROGMAN.EXE
    \WIN31\SYSTEM\SHELL.DLL
    WINHELP.EXE

LONGPTRADD (KERNEL.180)
    WINFILE.EXE

__ROMBIOS (KERNEL.173)
    (selector, not function)
    WINFILE.EXE

SCROLLCHILDREN (USER.463)
    \WIN30\PROGMAN.EXE

SETDESKPATTERN (USER.279)
    CONTROL.EXE

SETDESKWALLPAPER (USER.285)
    \WIN30\CONTROL.EXE

SETGRIDGRANULARITY (USER.284)
    \WIN30\CONTROL.EXE

SETINTERNALWINDOWPOS (USER.461)
    PROGMAN.EXE
    \WIN31\WINFILE.EXE

SWITCHTOTHISWINDOW (USER.172)
    TASKMAN.EXE

SYSTEMPARAMETERSINFO (USER.483)
    \WIN31\PROGMAN.EXE

TILECHILDWINDOWS (USER.199)
    TASKMAN.EXE
```

Figure 3: Microsoft shell software, such as Program Manager (PROGMAN) and File Manager (WINFILE), use these undocumented functions. Where no pathname is provided, the undocumented function is used by both versions 3.0 and 3.1 of Windows.

UNDOCUMENTED WINDOWS

Where you find particularly extensive use of undocumented Windows functions is, of course, in Microsoft's own software. It should not surprise you to find such functions used by shell software, such as Program Manager, and used by some of the debugging utilities included with the Windows SDK. But the sway of undocumented functions also extends to the company's commercial applications and its language products, as well. And, of course, the main use of undocumented Windows functions is internal, by the Windows DLLs themselves.

Let's first look at shell software: those applications that come with Windows and which many users confuse with Windows itself, but which are replaceable by alternate shells. Such software includes Program Manager (PROGMAN.EXE), Task Manager (TASKMAN.EXE), File Manager (WINFILE.EXE), and the old MS-DOS Executive (MSDOS.EXE). These seemingly integral parts of Windows are replaceable, using the SHELL= statement (and, in Windows 3.1, the TASKMAN.EXE= statement) in SYSTEM.INI. Figure 3 shows the census of undocumented API calls revealed by running MAPWIN on the shell software from Windows 3.0 and 3.1.

That such programs rely heavily on undocumented Windows calls clearly presents a problem if you want to write an alternative shell. We are already familiar with some of these functions, such as Get/SetInternalWindowPos, from our examination of *NDW*. Many of the others are used by PROGMAN.EXE in Windows 3.0 but not in 3.1. In 3.1, these functions—including CreateCursorIconIndirect(), DirectResAlloc(), DumpIcon(), GetIconID(), and LoadIconHandler()—are used instead by SHELL.DLL, which in turn is used by PROGMAN.EXE.

Moving the use of these undocumented calls out of PROGMAN.EXE and into SHELL.DLL in Windows 3.1 is commendable. It means that alternates to Program Manager have a better chance of duplicating its functionality. However, it is not clear to what extent the API provided by SHELL.DLL will be documented. Microsoft's SHELLAPI.H designates several functions—ShellExecute(), FindExecutable(), ShellAbout(), DuplicateIcon(), ExtractAssociatedIcon(), and ExtractIcon()—as "internal." These functions are all used by Version 3.1 of Program Manager. So it is not clear whether programmers of non-Microsoft shells will still be at a disadvantage by being forced to use functions that Microsoft regards as internal.

Since there are more intriguing-sounding functions listed in Figure 3 than we could possibly have room to explore here, let's instead focus on a single program, Task Manager (TASKMAN.EXE). TASKMAN is a particularly good example, not only because it makes many undocumented calls, but because these relate directly to the program's visible operation. Click the Cascade button in Task Manager and it calls CascadeChildWindows(); click the Tile button and it calls TileChildWindows(). The Switch To button corresponds to the SwitchToThisWindow() call. And finally, a glance at an assembly listing for TASKMAN explains the rather annoying fact that the End Task button can't be used to shut down a DOS box: The code for End Task calls the undocumented IsWinOldApTask() function to determine whether a given task actually *is* a DOS box.

What assembly listing for TASKMAN am I referring to? Aside from the way that its overt user interface relates directly to the undocumented functions it

A RESOURCE DUMP OF WINDOWS TASK MANAGER

```
C:\SOURCER>resdump \windows\taskman.exe
DIALOG 10 (0Ah), "Task List"
    LISTBOX 100 (64h), ""
    DEFPUSHBUTTON 1 (01h), "&Switch To"
    PUSHBUTTON 101 (65h), "&End Task"
    PUSHBUTTON 2 (02h), "Cancel"
    STATIC 99 (63h), ""
    PUSHBUTTON 102 (66h), "&Cascade"
    PUSHBUTTON 103 (67h), "&Tile"
    PUSHBUTTON 104 (68h), "&Arrange Icons"
```

Figure 4: Using RESDUMP, a program that comes with Sourcer on TASKMAN, produces this resource dump, which lets us match up numbers from TASKMAN.ASM with the resource ID numbers used by the various TASKMAN button controls.

C FUNCTION PROTOTYPES

```
/*
    Determine if a task belongs to the Windows WINOLDAP module,
    i.e., if it is a DOS ("old") application. The task handle
    parameter can be created from a window handle, using the
    documented GetWindowTask() function. Thus, an IsDOSWindow()
    function can easily be synthesized.
*/
BOOL FAR PASCAL IsWinOldApTask(HANDLE hTask);

/*
    Peforms the equivalent of a Task Manager "Switch To". The
    tRestore parameter determines whether an iconic window is
    restored, or switched to but left iconic.
*/
void FAR PASCAL SwitchToThisWindow(HWND hWnd, BOOL tRestore);

/*
    Rearranges the child windows of a specific parent into a
    cascaded formation. The Task Manager "Cascade" operation
    is equivalent to CascadeChildWindows(GetDesktopWindow()).
    MDI windows such as Program Manager must be handled differently,
    by sending a WM_MDICASCADE message, since MDI children are not
    direct descendents. The second parameter to CascadeChildWindows()
    is only for Windows 3.1, and specifies the window to retain
    the focus.
*/
#ifdef WIN31
void FAR PASCAL CascadeChildWindows(HWND hParent, HWND hFocus);
#else
void FAR PASCAL CascadeChildWindows(HWND hParent);
#endif

/*
    Rearranges the child windows of a specified parent into an
    old-style (Windows 1.x) tiled formation. See comment for
    CascadeChildWindows() above for further notes.
*/
void FAR PASCAL TileChildWindows(HWND hParent);
```

Figure 5: Here are C function prototypes for some undocumented functions used by the Windows Task Manager.

uses, another nice thing about TASKMAN is that it is a very small (3K) program which, when disassembled with V Communications' Windows Sourcer, produces a very clean, understandable TASKMAN.ASM. The only chore involved is to match up several "magic numbers" in the listing with the resource ID numbers used by the various TASKMAN button controls. The processor I wrote for Windows Sourcer includes a program called RESDUMP, which, as its name implies, dumps out such numbers. Running this on TASKMAN produces the results shown in Figure 4.

Once armed with these resource ID numbers, you can understand the flow of control in TASKMAN.ASM. What you'll find is that Task Manager is hardly more than a facade for some undocumented Windows functions. C function prototypes and explanatory material for these functions are shown in Figure 5. Note that by combining these undocumented functions with several documented functions you can synthesize a number of additional useful functions, such as IsDOSWindow() and TileDesktop(). This last puts the look and feel of Windows 1.*x* only a function call away.

UNDOCUMENTED DEBUGGING

Some SDK software programs also use undocumented functions. It should be noted that a few of these programs—including SPY, SHAKER, and SDKPAINT—use *no* undocumented functions. But the software listed in Figure 6 helps make the point that yet another feature of Windows that developers tend to take for granted—the ability to debug—is built on undocumented foundations. This recalls the situation in DOS, in which for years Microsoft "reserved" the key "load but don't execute" function used by debuggers such as DEBUG, SymDeb, and CodeView.

Not only does WINDEBUG.DLL, the Windows debugging library, use a number of undocumented functions (shown in Figure 6); even the interface it provides is undocumented! This interface, the WinDebug() function, is used by all available Windows debuggers, including CodeView for Windows (CVW), Turbo Debugger for Windows (TDW), and MultiScope. Use of WinDebug() usually does not show up in MAPWIN output because debuggers link to it at runtime via the amazing GetProcAddress() function.

Notice in Figure 6 that WINDEBUG.DLL imports both the IsTaskLocked() and LockCurrentTask() functions. Task locking prevents other Windows tasks from getting keyboard or mouse input. Its use by WinDebug() explains why—annoyingly, and unlike practically all other Windows applications—you cannot switch away from CVW and TDW.

There are alternatives to WinDebug(). The undocumented (at least in Version 3.0) KERNEL RegisterPtrace() function, for example, allows Windows notification functions to be installed. A notification function is called when Windows loads or terminates a task, loads a DLL, and so on. Unfortunately, only one notification function can be installed at any given time, but other debug interfaces could be built on top of it.

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UNDOCUMENTED WINDOWS FUNCTIONS IN THE SDK

```
ALLOCSELECTORARRAY (KERNEL.206)
    WINMEM32.DLL

DIRECTEDYIELD (KERNEL.150)
    WINDEBUG.DLL
    TOOLHELP.DLL

GETSELECTORBASE (KERNEL.186)
    WINMEM32.DLL
    WINDEBUG.DLL

GLOBALHANDLENORIP (KERNEL.159)
    HEAPWALK.EXE
    WINDEBUG.DLL

GLOBALMASTERHANDLE (KERNEL.28)
    HEAPWALK.EXE
    WINDEBUG.DLL
    TOOLHELP.DLL

ISTASKLOCKED (KERNEL.122)
    WINDEBUG.DLL

LOCKCURRENTTASK (KERNEL.33)
    WINDEBUG.DLL

OPENPATHNAME (KERNEL.75)
    HEAPWALK.EXE

REGISTERPTRACE (KERNEL.202)
    WINDEBUG.DLL
    TOOLHELP.DLL

SELECTORACCESSRIGHTS (KERNEL.196)
    WINMEM32.DLL

SETEVENTHOOK (USER.321)
    CVW.EXE (CodeView for Windows)

SETSELECTORBASE (KERNEL.187)
    HEAPWALK.EXE
    WINMEM32.DLL
    WINDEBUG.DLL

SETSELECTORLIMIT (KERNEL.189)
    HEAPWALK.EXE
    WINMEM32.DLL

WINDEBUG (WINDEBUG.1)
    CVW.EXE (via GetProcAddress)
```

Figure 6: This list of undocumented Windows functions used by Microsoft SDK tools shows that debugging in Windows is based on undocumented functions.

API provides documented functions for registering handlers. These include both InterruptRegister(), which can be used to install a handler for such exceptions as general-protection (GP) faults and even "bad" page faults, and NotifyRegister(), which can be used to catch the same events as handled by RegisterPtrace(). It's worth repeating that the TOOLHELP API, though available starting with the Windows 3.1 SDK, will also work under Windows 3.0.

Clearly, Microsoft wants to lure developers away from using the undocumented WinDebug() interface and toward writing Windows-hosted debuggers with TOOLHELP.DLL and some quasi-documented functions mentioned in the Open Tools materials. In other words, the reason why Microsoft doesn't document the important WinDebug() function is that they want to see it go away. (This in fact is often why Microsoft doesn't document seemingly crucial functions.) WinDebug() is simply *not* going to disappear overnight, however, so it is important that developers have documentation for it. On the other hand, TOOLHELP certainly is preferable in most cases, and it would be nice to see more use of TOOLHELP and less use of the undocumented functions that it supplants. TOOLHELP doesn't solve all the Windows problems that otherwise require undocumented functions, but it's an important step in the right direction.

COMMERCIAL APPS AND LANGUAGES

Probably no one objects to Microsoft using undocumented functions in its Windows debugging utilities. After all, debuggers are very much like system software—pieces of the operating system.

But what of application software such as *Microsoft Excel* for Windows? It's not difficult to see that *Excel* makes fairly heavy use of undocumented Windows: Just examine EXCEL.EXE and EXCELDE.EXE with the same MAPWIN utility we've been using to explore other Windows executables and libraries. The results are shown in Figure 7.

Some of these references are located inside a large table of function pointers in EXCEL.EXE, so it is difficult to tell exactly how *Excel* uses them. The calls GetTimerResolution(), SetSystemTimer(), and KillSystemTimer() are particularly intriguing, for these calls are related to asynchronous (preemptive) timers and so do not seem obviously related to the operation of *Excel*. The same functions are also used by the MSDRAW application that comes with *Microsoft Works for Windows*.

One way to see what's going on is to run *Excel* while Soft-ICE for Windows is loaded, setting breakpoints on all the undocumented functions in which you're interested. (Soft-ICE has symbolic information for all functions exported from KERNEL, USER, and GDI, even if they're undocumented.) The result shows that *all* of the functions listed in Figure 7 are indeed called while *Excel* is running. On the other hand, some of them are also called constantly even when *Excel* isn't running, and so must be used by parts of Windows itself.

What seems pretty clear is that *Excel* really does use these undocumented calls. How they all relate to the visible aspects of *Excel*, however, is less certain. The EndMenu() function, for example, can be used to close a menu when required by a more pressing event; FillWindow() simply paints a window using a given HBRUSH; GetControlBrush() retrieves an HBRUSH used for a given control.

Examining the PatchCodeHandle() function used by *Excel* opens another can of worms. As explained in the Open Tools documentation, Windows allows you to write "self-loading" Windows applications. Normally, this is done to work around a limitation of the WinExec() loader. Part of the process of writing your own Windows loader involves calling PatchCodeHandle() to create the standard Windows prologs and epilogs.

The problem with supplying this ability to write self-loading Windows executables, however, is that it invites everyone to come up with his own executable file format. So long as certain minimal criteria are met, for example, you could devise a new executable-file format that would decompress itself on the fly, as it was loading. While this opens up a wide range of interesting possibilities for Windows software, it also means that we may see the current consistent use of the segmented-executable (NE) format degenerate into a kind of "file format of the week" confusion, interfering with the use of standard development tools.

That suggestion is not farfetched. The

UNDOCUMENTED FUNCTIONS IN EXCEL

```
\EXCEL\EXCEL.EXE
    ENDMENU (USER.187)
    FILLWINDOW (USER.324)
    GET80X87SAVESIZE (SYSTEM.7)
    GETCONTROLBRUSH (USER.326)
    GETPHYSICALFONTHANDLE (GDI.352)
    GETTIMERRESOLUTION (USER.14)
    INQUIRESYSTEM (SYSTEM.1)
    KILLSYSTEMTIMER (USER.182)
    LOCALNOTIFY (KERNEL.14)
    PATCHCODEHANDLE (KERNEL.110)
    SETSYSTEMTIMER (USER.11)

\EXCEL\EXCELDE.EXE
    FILLWINDOW (USER.324)
    GETCONTROLBRUSH (USER.326)
```

Figure 7: Examining EXCEL.EXE and EXCELDE.EXE with MAPWIN reveals *Excel*'s fairly heavy use of undocumented Windows API functions.

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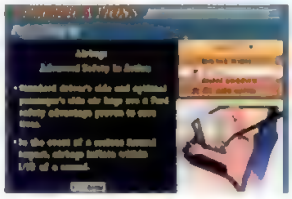

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UNDOCUMENTED FUNCTIONS IN VB AND QC/W

```
\VB\VB.EXE
    ENDMENU (USER.187)
    PRESTOCHANGOSELECTOR (KERNEL.177)

\QCWIN\BIN\QCWIN.EXE
    DIRECTEDYIELD (KERNEL.150)
    GETTASKQUEUE (KERNEL.35)
```

Figure 8: The use of undocumented functions in Visual Basic and Quick C for Windows is fairly light in comparison to their use in other Microsoft products.

first indication that this could happen is WINWORD.EXE, the executable file for Microsoft's own *Word for Windows*. Trying to run any standard segmented-executable tools on WINWORD.EXE reveals both a call to the PatchCodeHandle() function and then the presence of a completely nonstandard file format. Microsoft's own EXEHDR utility knows enough about this format to display a warning about "compressed relocation records" before it aborts. It's clear, then, that WINWORD .EXE uses its own home-brew compressed executable format, and this, unfortunately, precludes your examining it with any of the utilities I've mentioned in this column. (You could possibly use Soft-ICE to examine WINWORD's in-memory image, however.)

Microsoft's language products for Windows, Visual Basic and Quick C for Windows also use a few undocumented functions, as shown in Figure 8, although it's hard to decide whether the PrestoChangoSelector() function shown there is really undocumented. In the *Windows 3.0 Programmer's Reference*, a more sedate-sounding function, ChangeSelector(), is documented, but it is not exported from any Windows DLL or made available in the standard import libraries. The PrestoChangoSelector() function is available instead, however, though for obvious reasons this silly name was never documented. PrestoChangoSelector(), or ChangeSelector() if you prefer, is used to turn data segments into code segments. The function works by toggling a single bit in a descriptor table. In Windows 3.1, interestingly, ChangeSelector() and PrestoChangoSelector() are *not* equivalent: ChangeSelector() performs parameter validation and then calls PrestoChangoSelector(), which does no validation itself.

In almost all cases, Windows programs should use the documented AllocDStoCSAlias() function when data needs to be turned into code. Turning code into writable data isn't a good idea in an environment with shared, discardable code segments, but Windows does also provide an undocumented AllocCStoDSAlias() function.

All that is required to turn a code selector into a data selector, or a data selector into a code selector, is to toggle (XOR) a single bit in a protected-mode descriptor. In fact, if you use Soft-ICE or Sourcer to look at the source code for the Windows 3.0 implementation of PrestoChangoSelector(), it's easy to see why the function was given this seemingly ridiculous name. As shown in Figure 9, the code *does* work a sort of magic. Like other functions in the 3.0 KERNEL, PrestoChangoSelector() also magically ANDs a selector with 0FFF8h to turn it into the corresponding descriptor's offset in the protected-mode Local Descriptor Table (LDT).

Unfortunately, this neat bit of code is extremely unsafe, as it makes the unwarranted assumption that any selector it receives is valid and present in the LDT. Thus, passing in a bad value will instantly corrupt Windows's LDT. That flaw has been corrected in Windows 3.1, so that the code more sedately uses DPMI INT 31h calls to manipulate the descriptor table, as shown in Figure 10.

As a threaded-code interpreter, it makes sense that Visual Basic would call PrestoChangoSelector(). This function is always used either to write self-modifying code, or to execute data.

Quick C for Windows' use of the undocumented functions, also shown in Figure 8, makes sense as well. DirectedYield() (which is partially documented in the Open Tools materials) and GetTaskQueue() can be used by one task to manipulate another. The QCW integrated environment needs to orchestrate the task-switching between itself and a user's C program carefully, and such orchestration is really not possible with the documented Windows API.

INSIDE WINDOWS

Having discussed the way undocumented functions are used in Microsoft's shell programs, SDK utilities, applications, and "quick" language products, I turn finally to what is really the raison d'etre for undocumented Windows: its use internally by the Windows DLLs themselves. Each Windows DLL, DRV, and so on, uses functions from the other components of Windows, and some of these functions, naturally, are undocumented. It is completely legitimate to not document one's internal functions!

For example, the Windows GDI module imports functions from KERNEL. GDI makes no use of services, documented or otherwise, from the USER (windowing) module. The undocumented functions that Windows 3.0 GDI explicitly imports from KERNEL are shown in Figure 11. Windows 3.1 is somewhat different, also using our old friends, Get/SetSelectorBase.

Of course, the list of undocumented functions in Figure 11 hardly gives you a well-rounded view of how GDI and KERNEL interrelate. However, by walking the relocation information in an NE

PRESTOCHANGOSELECTOR()

```
PRESTOCHANGOSELECTOR proc far
    ENTER
    SAVE ds, si, di
    mov ds,cs:WIN_LDT
    mov es,cs:WIN_LDT
    mov si, wSourceSelector     ; [bp+8]
    mov di, wDestSelector       ; [bp+6]
    and si,0FFF8h               ; turn selector into LDT offset
    and di,0FFF8h               ; ditto
    mov ax,di
    mov cx,4
    cld
    rep movsw                   ; copy the 8-byte descriptor
    xor byte ptr [di-3],8       ; PRESTOCHANGO: toggle the code/data bit
    MOV es, 0                   ; push 0 / pop es
    or  al,5
    RESTORE di, si, ds
    LEAVE 4
PRESTOCHANGOSELECTOR endp
```

Figure 9: This code listing shows how PrestoChangoSelector() is implemented in Windows 3.0 KRNL386.EXE. It directly manipulates the Windows Local Descriptor Table.

PRESTOCHANGOSELECTOR()

```
PRESTOCHANGOSELECTOR proc far
    ; ...
    DPMICALL GET_DESC, [bp+8]       ; INT 31h AX=000Bh
    xor byte ptr [bp-3], 8          ; PRESTOCHANGO: code <==> data
    DPMICALL SET_DESC, [bp+6]       ; INT 31h AX=000Ch
    ; ...
PRESTOCHANGOSELECTOR endp
```

Figure 10: This code sample shows how PrestoChangoSelector() is implemented in Windows 3.1 KRNL386.EXE. It uses DPMI INT 31h calls to manipulate the LDT.

executable, it's easy to write a program that would show *how many* calls are generated to a function, whether documented or undocumented.

What you would find in this case is, unsurprisingly, that GDI relies on KERNEL for global memory allocation, locking, and (somewhat surprisingly in 3.1, where it shouldn't be necessary) unlocking. It should also be noted that GDI uses a number of *unnamed* functions provided by KERNEL. (This is possible because of imports by module.ordinal.) Since I'm stressing undocumented functions you can use in your own programs, I've downplayed such unnamed DLL functions. Still, it's important to know they exist.

The Windows USER module depends upon KERNEL, upon GDI, and upon almost all the device drivers that are part of Windows: SYSTEM, KEYBOARD, MOUSE, DISPLAY, SOUND, and COMM. Figure 12 shows the truly enormous number of undocumented functions used by USER in Windows 3.0. It's here that we really start moving into Windows internals.

C source code for two important parts of the USER module is included with the Windows SDK: \samples\defprocs\defwnd.c contains the source for the DefWindowProc() function, and \samples\defprocs\defdlg.c contains the code for DefDlgProc(). This code provides a rare inside peek at the actual source for Windows. Here you'll learn, for example, that the author of DefWindowProc() has no apparent hesitation about writing a single function that's 550 (!) lines long, but is embarrassed enough about using a GoTo statement that the label ICantBelieveIUsedAGoTo-Statement appears in the code. The code also helps us disassemble other parts of USER and serves as a reminder that some of the chief users for undocumented functions exported from a DLL are other parts of the same DLL. For example, defwnd.c shows that the undocumented EndMenu() function exported from USER is used by the DefWindowProc() function in USER. Such internal calls are not displayed by MAPWIN.

After this rather cursory examination of the undocumented functions used by GDI and USER, it's time to look at KERNEL.

As its name implies, KERNEL is supposed to sit at the center of the operating system. And sure enough, running MAPWIN on KRNL286.EXE or KRNL386.EXE turns up no modules that

> The Windows KERNEL is not really a *kernel*, after all. If you try to draw a diagram of how the different modules interrelate, you'll find it impossible to draw a directed graph.

KERNEL itself depends upon and no functions that it calls in any other DLL. However, the GetProcAddress() function is part of KERNEL. KERNEL itself uses this function, particularly its initialization code, and especially as part of booting Windows. KERNEL loads the other Windows modules by calling functions they export. These functions, both documented and undocumented, are shown in Figure 13, to give some idea of how KERNEL actually touches numerous other parts of Windows.

This is somewhat depressing, for it means that the Windows KERNEL is not really a *kernel*, after all. If you try to draw a diagram of how the different Windows modules interrelate, you'll find it impossible to draw a directed graph. Instead, the result looks more like a drunken spider's web. It gets even worse if you take into account DOSX.EXE in Standard mode and WIN386.EXE and assorted .386 files in Enhanced mode. The architecture of Windows is baroque.

I've said very little about what undocumented functions various DLLs export, as the point here is to find functions that someone actually *uses*. Returning to the search for undocumented functions that are imported by the different components of Windows, I'll turn now to the different device drivers (*.DRV files). Note that the driver's module name (for example, DISPLAY) often does not correspond with the filename (for example, VGA.DRV). A DISPLAY driver must present a certain functional interface, details of which are spelled out in the Windows Device Driver Kit (DDK) documentation, but how this is implemented is up to the specific driver. One of the strengths of Windows is that disparate devices are wedged into a common mold so that they all look the same to Windows.

Figure 14 shows undocumented calls made by various Windows device drivers. In most cases, assembly language source code for these drivers is provided on-disk with the must-have Windows DDK. Given the code, even though the functions used remain undocumented, you can at least see how they are called and what they're supposed to do. Source for SYSTEM.DRV is provided only as part of the extremely expensive Windows OEM Binary Adaptation Kit (BAK), but this small file yields an extremely clean disassembly listing under Sourcer.

WHY AREN'T THEY DOCUMENTED?

By now you will have seen a certain pattern in our exploration. Some Windows API

GDI AND UNDOCUMENTED FUNCTIONS

```
\WIN30\SYSTEM\GDI.EXE
    DELETEPATHNAME (KERNEL.76)
    GETCURPID (KERNEL.157)
    GETEXEVERSION (KERNEL.105)
    LOCALCOUNTFREE (KERNEL.161)
    LOCALHEAPSIZE (KERNEL.162)
    LONGPTRADD (KERNEL.180)
    NOHOOKDOSCALL (KERNEL.101)
    PRESTOCHANGOSELECTOR (KERNEL.177)
```

Figure 11: A list of the undocumented KERNEL functions used by Windows 3.0 GDI.

names keep coming up again and again, and clearly these functions and selectors have proven useful to serious Windows developers. In Figure 15 I've attempted to present a sort of "top 20 hit parade"—actually there are 25—of undocumented calls and selectors.

In one sense, it is naive to ask why Microsoft Windows has undocumented functions. *Any* system of such complexity is bound to contain many functions that aren't described to outsiders. In fact, given how difficult Windows programming can be, someone might well wish that Windows hid *more* of its functions. Still, for the highly useful—in some cases critical—functions we've considered above, the question does cry out: Why are *these* functions undocumented?

If you spend a few hours examining some of these undocumented functions, you'll quickly learn why Microsoft doesn't document them. While the documented interfaces are admittedly not models of order, the undocumented functions uncovered here are a *mess*. Clearly, they were thrown together as ad hoc fixes at various points during Windows' evolution. The problems they address are very real, which is why Microsoft needed to create the undocumented functions, and also why outsiders need to know about them. But the solutions are far from perfect.

One reason, then, why Microsoft often declines to document one of these functions is that it wants to come up with a better, less makeshift solution, and document *that*. As we've seen, for example, rather than document the embarrassingly messy WinDebug() function, Microsoft instead worked to provide equivalent functionality as part of the documented TOOLHELP interface. PrestoChangoSelector() is another example. Unfortunately, however, this concern for eventual tidiness doesn't help the poor programmer who needs a solution *today*. That poor programmer might even work at Microsoft.

In addition to a desire to provide neat functions rather than document existing messy ones, another typical sentiment at Microsoft is that documenting these for-internal-consumption-only interfaces will hold back future changes. In a company whose primary product seems to be change itself, documenting system internals is definitely not attractive.

Still another reason for failing to document these functions is the mistaken notion that very few Windows programmers need to know about them. Microsoft has consistently failed to recognize the fact that many, many applications simply must be able to access real-mode DOS from protected-mode Windows, for example. Consequently, as we saw in Part I, the key Windows services for doing so are undocumented.

Some of these undocumented functions are extremely powerful: Get/SetSelectorBase/Limit alone opens up enormous vistas for many programmers. With this small set of functions you can do almost anything that would otherwise be prohibited in Windows! Consequently, these functions are also very "dangerous." Moreover, they are also extremely Intel-specific, and Microsoft anticipates moving Windows to non-Intel architectures such as the MIPS R4000. Even though the implementation of these functions has been considerably improved in Windows 3.1 (they use the underlying DPMI calls rather than blindly banging on the Local Descriptor Table, as they did in Version 3.0), they are still not documented because they are judged to be far too dangerous for ordinary Windows programmers. This is understandable; however, it perpetuates what is in fact a myth: that protected mode is in any way truly protected.

For all my talk about Microsoft's unwillingness to divulge information on undocumented functions, it must also be admitted that Microsoft has a history of documenting undocumented functions if enough people use them and scream that they need to be documented. For example, the first edition (1988) of Charles Petzold's classic *Programming Windows* contained a section on "Undocumented File I/O Functions"; Microsoft documented these functions in Windows 3.0. Similarly, Tim

UNDOCUMENTED FUNCTIONS IN USER

```
\WIN30\SYSTEM\USER.EXE
    CALLPROCINSTANCE      (KERNEL.53)
    CREATEUSERBITMAP      (GDI.407)
    CREATEUSERDISCARDABLEBITMAP (GDI.409)
    DEATH    (GDI.121)
    DELETEABOVELINEFONTS      (GDI.186)
    DIRECTRESALLOC  (KERNEL.168)
    EMSCOPY (KERNEL.160)
    EXITKERNEL  (KERNEL.2)
    FASTWINDOWFRAME (GDI.400)
    FINALGDIINIT     (GDI.405)
    GDIINIT2     (GDI.403)
    GDIMOVEBITMAP    (GDI.401)
    GDIREALIZEPALETTE    (GDI.362)
    GDISELECTPALETTE     (GDI.361)
    GETCLIPRGN  (GDI.173)
    GETCURLOGFONT    (GDI.411)
    GETCURPID    (KERNEL.157)
    GETDCSTATE  (GDI.179)
    GETEXEPTR    (KERNEL.133)
    GETEXEVERSION    (KERNEL.105)
    GETEXPWINVER     (KERNEL.167)
    GETTASKDS    (KERNEL.155)
    GETTASKQUEUE     (KERNEL.35)
    GETTASKQUEUEDS   (KERNEL.118)
    GETTASKQUEUEES   (KERNEL.119)
    GLOBALHANDLENORIP    (KERNEL.159)
    INQUIREVISRGN    (GDI.131)
    INTERSECTVISRECT     (GDI.98)
    ISDCCURRENTPALETTE   (GDI.412)
    ISDCDIRTY    (GDI.169)
    ISVALIDMETAFILE (GDI.410)
    ISWINOLDAPTASK   (KERNEL.158)
    LOCALCOUNTFREE   (KERNEL.161)
    LOCALHEAPSIZE    (KERNEL.162)
    LOCKCURRENTTASK (KERNEL.33)
    OLDYIELD     (KERNEL.117)
    POSTEVENT    (KERNEL.31)
    REALIZEDEFAULTPALETTE    (GDI.365)
    RESTOREVISRGN    (GDI.130)
    RESURRECTION     (GDI.122)
    SAVEVISRGN   (GDI.129)
    SELECTVISRGN     (GDI.105)
    SETDCORG     (GDI.117)
    SETDCSTATE   (GDI.180)
    SETDCSTATUS (GDI.170)
    SETPRIORITY (KERNEL.32)
    SETTASKQUEUE     (KERNEL.34)
    SETTASKSIGNALPROC    (KERNEL.38)
    SHRINKGDIHEAP    (GDI.354)
```

Figure 12: A list of the undocumented functions used by USER in Windows 3.0.

WINDOWS API FUNCTIONS IN KERNEL

```
InquireSystem (system.1)
Get80x87SaveState (system.7)
CreateSystemTimer (system.2)
DisableSystemTimers (system.5)
UserPaintDisable (display.500)
Disable (mouse.3)
MessageBox (user.1)
SysErrorBox (user.320)
ExitWindows (user.7)
DisableOEMLayer (user.4)
UserYield (user.332)
FinalUserInit (user.400)
SetSystemTimer (user.11)
SignalProc (user.314)
IsUserIdle (user.333)
StringFunc (user.470)
GetFocus (user.23)
GetWindowTask (user.224)
IsWindow (user.47)
AnsiToOEM (keyboard.5)
OEMToAnsi (keyboard.6)
Disable (keyboard.3)
EnableKbSysReq (keyboard.136)
Inquire (keyboard.1)
```

Figure 13: Functions, both documented and undocumented, that the Windows 3.0 KERNEL calls in other Windows modules. KERNEL links to these functions at runtime via GetProcAddress().

UNDOCUMENTED CALLS IN DEVICE DRIVERS

```
KEYBOARD.DRV (source provided with DDK)
    __ROMBIOS (KERNEL.173)
    CVWBREAK (KERNEL.205)
    DOSIGNAL (KERNEL.139)
    KBDRST (KERNEL.123)

SYSTEM.DRV
    __ROMBIOS (KERNEL.173)
    NOHOOKDOSCALL (KERNEL.181)

VGA.DRV (source provided with DDK)
    GETEXEPTR (KERNEL.133)
    PRESTOCHANGOSELECTOR (KERNEL.177)

COMM.DRV
    GETSELECTORBASE (KERNEL.186)

PEN\SCRIPTEL.DRV (source provided with Pen SDK)
    GETMOUSEEVENTPROC (USER.337)
    GETSELECTORBASE (KERNEL.186)
```

Figure 14: For certain device drivers, the assembly language source code is in the DDK. So although the functions may be undocumented, you can see how they are called.

Paterson and Steve Flenniken, in the February and March 1990 issues of *Dr. Dobb's Journal* described the undocumented Windows memory management function DefineHandleTable(). This, too, was documented in Windows 3.0 (though not very well, perhaps because the function's importance was limited to Real mode).

UNDOCUMENTED FUNCTIONS SAFETY

The history of how yesterday's undocumented Windows functions can become tomorrow's documented functions is relevant to the interesting and important question: How *safe* is it to use undocumented functions? If the most useful undocumented functions are destined to be documented—and if, through an odd kind of marketplace democracy, the fact that many people are using them helps *force* Microsoft to document them—then clearly they are safe to use.

Others have a different opinion. Many programmers feel that it is dangerous to use undocumented functions. For example, Peter Norton and Paul Yao's excellent book, *Peter Norton's Windows 3.0 Power Programming Techniques* states: "It has been our experience that 'undocumented goodies' are interesting to look at, but dangerous to include in software that is intended for general distribution." (p. 108)

There's a certain irony in hearing Peter Norton say that when, in this article, we've documented the almost flagrant use of undocumented functions in his own *Norton Desktop for Windows*. In a way, though, that ambivalence pretty much epitomizes the situation. A great deal of shrink-wrap commercial software, undeniably intended for general distribution, uses these undocumented functions because the authors *had no choice*. Yet the same authors decry the practice as dangerous.

In what way is it unsafe to use undocumented functions? It's important to pin this down. Undocumented functions, of course, are *not* unsafe in the sense that they will work one million times and then, on the million and first call, will reformat the user's hard disk. Instead, there are two ways in which undocumented functions are less safe than documented functions:

- There may be boundary conditions or odd circumstances in which the functions do not behave as advertised. This is a major reason, in fact, why they're *not* advertised! A good example of this is the failure of the call GetSelectorBase(__0040H) in Windows 3.0.
- The function may change, or be removed entirely, in some future version of Windows. This is usually what is meant when people say that it is unsafe to use undocumented functions. By leaving a function undocumented, Microsoft incurs no obligation to continue providing it. Of course, that a function is documented is no guarantee that it won't be removed, or at least de-documented. That happened, for example, to Get/SetRelAbs and LocalNotify in Windows 3.0.

What is to be said to the argument that using undocumented functions is ipso facto "bad engineering?" I put this phrase in quotes because, it keeps recurring so often in conversations on this topic. I must simply reply that the idea that using undocumented functions is "bad engineering" is based on a misunderstanding of how software engineering (or any engineering, really) works in the real world. Unlike pure science, engineering is by nature full of compromises.

Finally, what should be the response to the feeling—certainly within Microsoft, and to some extent outside it—that use of undocumented functions is bad because it will hold back Microsoft's ability to make sweeping changes to the system? Frankly, if using undocumented functions acts as a partial *drag* on Microsoft's ability to change Windows, I'm all for it! While the sweeping changes of Windows 3.0 (incorporating a protected-mode DOS extender) and 3.1 (getting rid of Real mode) are unquestionably welcome, other changes contemplated by Microsoft seem dictated less by customer demand than by an unconscious need to prove that IBM is not the only company that can produce large, unwieldy systems that few users even want.

There is a great deal of excitement right now about the future Windows NT (new technology), and it is certainly legitimate to ask whether Windows applications with undocumented calls will run under the new Windows NT. The primary change in terms of undocumented Windows functions is that *all* selector-

A "TOP 25" LIST

```
__0000H
__0040H
CascadeChildWindows
DirectResAlloc
DumpIcon
EndMenu
GetHeapSpaces
GetInternalWindowPos
GetSelectorBase
GetSelectorLimit
GetSpoolJob
GlobalHandleNoRIP
GlobalMasterHandle
IsWinOldApTask
KillSystemTimer
LoadIconHandler
PrestoChangoSelector
RegisterPtrace
SetDeskWallpaper
SetInternalWindowPos
SetSelectorBase
SetSelectorLimit
SetSystemTimer
TileChildWindows
WinDebug
```

Figure 15: A summary of the "Top 25" undocumented function calls and selectors.

manipulation functions, whether documented or undocumented, will be dropped from the 32-bit Windows API.

Note, however, that Microsoft claims that existing 16-bit Windows applications will run unmodified, out of the box, under NT. Given the extensive use of undocumented Windows by applications such as *NDW*, that means that Microsoft will have to provide the undocumented API for 16-bit Windows applications running under NT if it is to live up to its promises. The question then becomes: What facilities, if any, will Microsoft provide for *mixing*, that is, for calling 16-bit API functions from 32-bit Windows code?

In the past, Microsoft has consistently underestimated the need for mixing—failing to see the pressing need that many developers would have for calling real-mode code from their protected-mode Windows applications, for example. For safety's sake, undocumented functions should be used somewhat differently from the way you would use those described in the SDK or prototyped in WINDOWS.H. Even though both documented and undocumented functions have the exact same source—the DLLs that make up Windows—the undocumented functions really *are* different: They could be removed or altered in some fundamental way in the very next release of Windows. Therefore, you should check that the function exists before the first time you call it.

How can you check whether a Windows function exists? By using one of Windows's most magical features, runtime dynamic linking. Figure 16 shows a function, GetProc(), which you can use to get the callable address of a Windows API function. By design, GetProc() is extremely paranoid: It will return zero if something is fishy. Before using an undocumented function, you should declare a pointer to it, complete with prototype, and then call GetProc(). You'll need to know both the function's name and its module.ordinal. For example, Figure 16 also shows a sample use with GetSelectorBase() (KERNEL.186). The GetProc() function provides paranoia checking, and it can easily be adapted to languages other than C, such as BASIC or Turbo Pascal.

> In the future Windows NT *all* selector-manipulation functions, whether documented or undocumented, will be dropped from the 32-bit Windows API.

Furthermore, as I noted in last issue's Lab Notes column, you should also make sure to use the Windows GetVersion() call when an undocumented call has known differences from one version of Windows to another.

GETPROC()

```
FARPROC GetProc(char *szModule, char *szFunction, int nOrdinal)
    {
    HANDLE hModule;
    FARPROC lpfnByName;
    FARPROC lpfnByOrd;

    if (! (hModule = GetModuleHandle(szModule)))
        if (! (hModule = LoadLibrary(szModule)))
            return 0;
    if (! (lpfnByName = GetProcAddress(hModule, szFunction)))
        return 0;
    if (! (lpfnByOrd = GetProcAddress(hModule, nOrdinal)))
        return 0;
    if (lpfnByName != lpfnByOrd)
        return 0;
    /* still here */
    return lpfnByName;
    }

/* sample use */
DWORD FAR PASCAL (*GetSelectorBase)(WORD sel);
if (! (GetSelectorBase = GetProc("KERNEL", "GETSELECTORBASE", 186)))
    fail("Windows KERNEL has changed! Please downgrade to an old version!");
// ...
foo = GetSelectorBase(bar);
```

Figure 16: The GetProc() function provides paranoia checking and should be used before calling an undocumented function.

BEYOND FUNCTIONS

This two-part Lab Notes has only provided an introductory glance at undocumented Windows API functions. There is much more that could be said about each of them, and there are useful undocumented functions that have not been discussed here at all.

Furthermore, there's a lot more to undocumented Windows functions than API functions. I've said nothing at all about undocumented WM messages (the WINSIGHT program that comes with Borland C++ 3.0 is a good source of information on these); about the nearly undocumented INT 2Fh calls that Windows provides for DOS programs; about a number of undocumented DPMI calls that are used by various parts of Windows; about the Windows memory map (arrangement of its linear address space); about how Windows handles interrupts and exceptions; about how the documented API functions are implemented; or about how the various pieces of Windows fit together (what do WINA20.386 or WINOA386.MOD really do?).

Then there are questions about the behavior of the built-in control classes, functions provided in the Kanji version of Windows sold by NEC, questions about Windows internal data structures—the list goes on and on. Hopefully, however, what I have been able to say here will have at least whetted your appetite for exploring Windows and learning more about its internals and undocumented aspects. Windows is such a large and complex system, with so many hidden areas, it should keep a lot of us employed for a very long time. ■

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Sometimes, the worst thing you can do to a drug user is the only way to help.

Drug use is a question of extremes. People who use drugs are either addicted or in danger of addiction.

The results of drug addiction are poor performance, absenteeism, theft, robbery, industrial accidents, and death.

And addicts often take others down with them. Loved ones, co-workers, even employers.

Addicts seldom get well or even get into treatment by themselves. Someone has to help. You could be that person. If you're willing to get involved.

When you say, in no uncertain terms, "Get well or get out," you may be awakening the addict to the one reality that can save her.

Threatening to fire an addict is the worst thing you can do to her. Or the best. If it gets her into treatment.

To find out how to set up a treatment program in your company, please call 1-800-843-4971. That's the National Institute on Drug Abuse hot line for managers and CEOs. It's manned by trained Employee Assistance Program planners and designers, from Monday through Friday, 9:00 a.m. to 8:00 p.m. Eastern Time. They won't tell you what to do, but they can outline the options.

Partnership for a Drug-Free America

by
Charles Petzold

Environments

Storing Sound: A Look At Waveform Audio Sound Files

■ Multimedia Windows' high-level interface uses files rather than memory blocks to record and play back waveform audio sound, in a tagged format known as RIFF (Resource Interchange File Format).

As we've seen in the past few columns, programmers can use the waveform audio facilities of the Multimedia Extensions to Windows through either a low-level or high-level programming interface. With the low-level interface, you use functions beginning with the prefix `wave`. Sound is recorded into global memory blocks and played back from these blocks.

The high-level interface is called MCI (Media Control Interface) and uses files rather than memory blocks to record and play back waveform audio sounds. MCI is available through either a message and structure interface or command strings. In either case, files with the extension WAV are recognized as waveform audio files.

In this column, I'd like to explore these waveform files and discuss two more high-level functions that can play waveform sounds.

THE WAVEFORM AUDIO FILE FORMAT

Multimedia Windows is supplied with several waveform audio files that are stored in the MMDATA subdirectory of your Windows directory. The MCI programs I've discussed previously also create .WAV files. You can create waveform audio files using the Sound Recorder program included in Multimedia Windows, or the MCITEST and WAVEEDIT programs supplied with the *Multimedia Developers Kit (MDK)*.

If you take a look at these .WAV files with a hexadecimal dump program, you'll find they have a format as shown in Figure 1. This format is an example of a more extensive format known as RIFF (Resource Interchange File Format): the all-encompassing format for Multimedia Windows data files. All multimedia data can (and should) be stored in the RIFF format.

RIFF is a tagged file format, where the file consists of "chunks" of data identified by a preceding 4-character ASCII name and a 4-byte (32-bit) chunk size. The value of the chunk size does not include the 8 bytes required for the chunk name and size.

A waveform audio file begins with the text string "RIFF", identifying it as a RIFF file. A 32-bit chunk size follows, which is the size of the remainder of the file, or the file size less 8 bytes.

The chunk data begins with the text string "WAVE", which identifies it as a waveform audio chunk. Another text string, "fmt " (note the blank to make this a 4-character string) follows, identifying a sub-chunk containing the format of the waveform audio data. The "fmt " string is followed by the size of the format information, in this case 16 bytes. The format information is a 16-byte PCMWAVEFORMAT structure, which I've discussed in past columns.

PCMWAVEFORMAT begins with a WAVEFORMAT structure. WAVEFORMAT's first field is wFormatTag—the format type of the data—currently defined as being WAVE_FORMAT_PCM (equal to 1), which indicates pulse code modulation. Future versions of Multimedia Windows may define other formats for waveform audio.

The nChannels field is either 1 or 2, for monaural or stereo sound. The nSamplesPerSec field is the number of samples per second; the standard values are 11,025, 22,050, and 44,100. The nAvgBytesPerSec field is the sample rate in samples per second times the number of channels times the size of each sample in bits, divided by 8 and rounded up. The standard sample sizes are 8 and 16 bits. The nBlockAlign field is the number of channels times the sample size in bits, divided by 8 and rounded up. Finally, the PCMWAVEFORMAT structure concludes with an nBitsPerSample field: the number of channels times the sample size in bits.

The format information is followed by the text string "data", followed by a 32-bit data size, followed by the waveform data itself. This data is uncompressed and simply consists of the consecutive samples. The data is in the same format used in the low-level waveform audio facilities. If the sample size is 8 bits or less, each sample consists of 1 byte (for monaural) or 2 bytes (for stereo). If the sample size is between 9 and 16 bits, each sample is 2 bytes (monaural) or 4 bytes (stereo). For stereo waveform data, each sample consists of the left value followed by the right value.

For sample sizes of 8 bits or less, the sample byte is interpreted as an unsigned value. (For an 8-bit sample size, for instance, silence is equivalent to a string of 0x80 bytes.) If the sample size is 9 bits or more, the sample is interpreted as a signed value, and silence is equivalent to a string of 0 values.

RESOURCE INTERCHANGE FILE FORMAT

A complete discussion of RIFF appears in the *Programmer's Reference* of the *Multimedia Developers Kit*. A RIFF file consists of one or more "chunks" that are identified by a 4-character uppercase name and a 4-byte data size, followed by the chunk data. The 4-byte size does not include the 8 bytes required for the name and size bytes.

In the case of a waveform audio file, the chunk name is "RIFF" and the data size is the second 4 bytes of the file. The chunk data begins with the word "WAVE", but "WAVE" does not introduce a new chunk. You'll notice that it's not followed by a chunk size.

Instead, the "WAVE" identifier is followed by two sub-chunks. The first of these sub-chunks uses the chunk identifier "fmt " and the second uses the chunk identifier "data." Both are followed by 4-byte chunk data sizes. Chunk sizes should be rounded up to the next highest multiple of 2.

One of the important rules for reading tagged files is to ignore chunks you're not prepared to deal with. Although a waveform audio file requires "fmt " and "data" sub-chunks (in that order), it may contain other sub-chunks as well. In particular, a waveform audio file may include a sub-chunk labeled "INFO", and sub-sub-chunks within that sub-chunk that provide information about the waveform audio file.

The table in Figure 2 shows a possible INFO sub-chunk that could appear in a waveform audio file. This sub-chunk contains three sub-sub-chunks with the chunk labels "INAM" (name), "ICOP" (copyright), and "ICRD" (creation date).

AN INFORMATION SUB-CHUNK

```
Bytes   Data
-----   ----
  4     "INFO"
  4     80
  4     "INAM"
  4     12
 12     "Audio Logo\0\0"
  4     "ICOP"
  4     32
 32     "Copyright 1991, Charles Petzold\0"
  4     "ICRD"
  4     12
 12     "1991-10-30\0\0"
```

Figure 2: An information sub-chunk like this could appear in any waveform audio file.

Similar information sub-chunks could appear in other RIFF files. This sub-chunk could appear before the format sub-chunk, between the format sub-chunk and data sub-chunk, or after the data sub-chunk. And others could be in there as well.

> One of the rules for reading tagged files is to ignore chunks you're not prepared to deal with.

So, if you need to dig data out of a waveform audio file, skip any sub-chunks you don't recognize or you're not prepared to deal with. This is very easy because the size of the sub-chunk follows the chunk identifier.

SOUND NAMES

Waveform files can be associated with "sound names," which are entries in the "[sounds]" section of the WIN.INI file in an installed version of Multimedia Windows. These sound names can be used with MCI and with the sndPlaySound function. (I'll discuss this in detail in just a moment.)

The entries in the "[sounds]" section of WIN.INI have the format

```
SoundName=FileName
```

For example, you'll find two entries that look something like this:

```
SystemStart=c:\mmwin\mmdata\water.wav
SystemExit=c:\mmwin\mmdata\bells.wav
```

These are the sound files that are played when you start Multimedia Windows and when you exit it. You'll also find the following entries:

```
SystemDefault=
SystemAsterisk=
SystemExclamation=
SystemHand=
SystemQuestion=
```

with other .WAV files following the equal signs. These are used in connection with the MessageBeep function, which I'll describe shortly.

The Multimedia Clock program uses the "[sounds]" section of WIN.INI for storing .WAV filenames that the program uses to chime and sound an alarm. You can add new sound names—or change the filenames associated with existing sound

THE .WAV FILE FORMAT

```
Offset  Bytes   Data
------  -----   ----
 0000       4   "RIFF"
 0004       4   size of waveform chunk (file size - 8)
 0008       4   "WAVE"
 000C       4   "fmt "
 0010       4   size of format chunk (16 bytes)
 0014       2   pcm.wf.wFormatTag = WAVE_FORMAT_PCM = 1
 0016       2   pcm.wf.nChannels
 0018       4   pcm.wf.nSamplesPerSec
 001C       4   pcm.wf.nAvgBytesPerSec
 0020       2   pcm.wf.nBlockAlign
 0022       2   pcm.wBitsPerSample
 0024       4   "data"
 0028       4   size of waveform data
 002C           waveform data
```

Figure 1: The waveform audio file format is an example of a more extensive format known as RIFF (Resource Interchange File Format): the all-encompassing format for Multimedia Windows data files.

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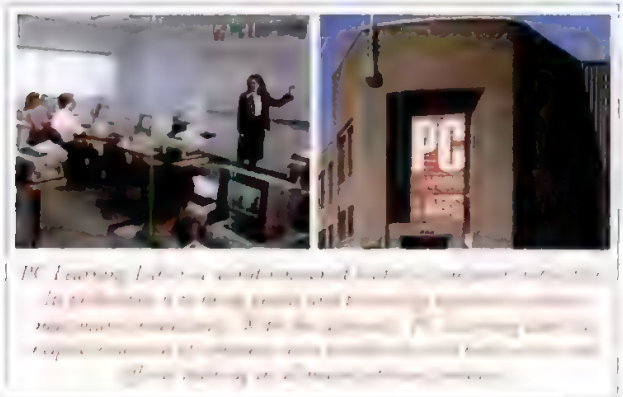

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CIRCLE 350 ON READER SERVICE CARD

names—by invoking the Sound option in the Multimedia Windows Control Panel. A program can access the filename associated with a sound name or add new entries using the standard GetProfileString and WriteProfileString functions.

THE SNDPLAYSOUND FUNCTION

The simplest function that can be used to play waveform audio files is probably the sndPlaySound function, which has the following syntax:

```
BOOL sndPlaySound (lpszSound,
  wFlags)
```

This is the only function in the multimedia extensions that has the "snd" prefix. The first parameter is assumed to be a sound name listed in the "[sounds]" section of WIN.INI. If a sound name can't be found, then it's assumed to be a waveform audio filename. If the file can't be found, the function plays the waveform audio file associated with the SystemDefault sound name. In any case, the waveform audio file must fit in available memory. The sndPlaySound function returns FALSE if there's no SystemDefault entry or if the file associated with SystemDefault can't be found.

Six flags may be specified in the second parameter. The default is SND_SYNC (equal to 0), which means that the function doesn't return until the sound is finished playing. Alternatively, you can specify SND_ASYNC to play the sound asynchronously. In this case, the function returns immediately and the sound plays in the background. If you want to stop a sound that sndPlaySound is currently playing, you can call

```
sndPlaySound (NULL, 0) ;
```

If you use the SND_ASYNC flag, you can also include the SND_LOOP flag to play the sound over and over again. You stop the loop by calling sndPlaySound with a first parameter of NULL.

Normally sndPlaySound plays a waveform audio file, but if you use the SND_MEMORY flag, then the first parameter to sndPlaySound is assumed to be a pointer to a memory block containing a memory image of a waveform file. This makes it very easy to include .WAV waveform files as programmer-defined resources in your program. You use LoadResource and LockResource to get a pointer to the memory block containing the file, and simply pass that pointer to sndPlaySound with the SND_MEMORY flag.

The two additional flags are SND_NODEFAULT and SND_NOSTOP. SND_NODEFAULT prevents the function from playing the default sound if the requested sound can't be found. The SND_NOSTOP flag causes the function to return FALSE if another sound is currently playing.

THE MESSAGEBEEP PARAMETER

wType	Sound
-1	The PC beep
0	"SystemDefault" sound
MB_ICONASTERISK	"SystemAsterisk" sound
MB_ICONEXCLAMATION	"SystemExclamation" sound
MB_ICONHAND	"SystemHand" sound
MB_ICONQUESTION	"SystemQuestion" sound

Figure 3: In non-multimedia versions of Windows the wType parameter is not used. Here's how it's used in Multimedia Windows.

Using the MessageBeep function is the easiest way to make your Windows programs "multimedia aware" without adding specific multimedia calls.

THE NEW MESSAGEBEEP FUNCTION

MessageBeep has been in Windows since Version 1.0, but it was always defined a little peculiarly. The syntax is

```
void MessageBeep (wType) ;
```

In normal (non-multimedia) versions of Windows the wType parameter is not used and "should be set to zero," according to the *Microsoft Windows Programmer's Reference*. (Actually the wType parameter is ignored, so you can really set it to anything.) In Multimedia Windows, the wType parameter takes on new meaning, as shown in Figure 3.

Notice that the wType values beginning with the prefix MB are the constants used in the MessageBox function to specify the type of icon displayed. Using the MessageBeep function is the easiest way to make your existing Windows programs "multimedia-aware" without adding specific multimedia function calls. Generally you use MessageBeep prior to making a MessageBox call. Simply pass the same parameter to MessageBeep that you use to specify the icon in MessageBox, like this:

```
MessageBeep (MB_ICONASTERISK) ;
MessageBox (hwnd, "File Not
  Found!", NULL, MB_OK |
  MB_ICONASTERISK) ;
```

Be sure to call MessageBeep before MessageBox, because MessageBox doesn't return until the user terminates the message box display.

Under non-multimedia versions of Windows, MessageBeep simply beeps the PC speaker regardless of the parameter. With the Multimedia Extensions installed, MessageBeep plays the user-defined sound file. Because many existing programs simply call MessageBeep with a zero parameter, you'll probably want to define your SystemDefault sound to be something short and simple.

You can have fun with these sound names. I've recorded my voice in sound files and set the SystemAsterisk, SystemExclamation, SystemHand, and SystemQuestion sounds to files containing the spoken words "Hey," "Whoa," "Stop," and "Huh?" Interestingly enough, it seems as if the ear can respond quicker to these phrases than the eye in identifying the corresponding icons. ■

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CIRCLE 187 ON READER SERVICE CARD

by
Sal Ricciardi

Databases

ANIMATED FRAMES

User-defined functions are a powerful *Clipper* feature, but they have more uses than just letting you write routines to calculate values. The routine shown in Figure 1 is ideal for creating an eye-catching message. It creates a moving marquee, with variable size and speed. It waits for a keypress and returns the INKEY() code to the calling program.

The routine, named FRAME, is called with five parameters. The first four numeric values are the standard row1, col1, row2, col2 coordinates for the frame. The fifth value is the speed of the frame, with a lower value producing a faster-moving frame. You can adapt the routine to display different frame types by using the @..BOX command to draw the frame. For example, for a different effect, replace the two lines that read

```
@ ulrow, ulcol TO
  lrrow, lrcol DOUBLE
```

with the following:

```
@ ulrow, ulcol,
  lrrow, lrcol BOX
  REPLICATE(CHR(219),8)
```

By changing the character code in the BOX statement (219), you can create a variety of frame styles.

Peter M. L. Lottrup
Buenos Aires, Argentina

■ ANIMATED FRAMES: A *Clipper* function that lets you create an eye-catching message.

FRAME FUNCTION

```
*************************************************************
* FRAME function - Display a box with flashing borders.  Clipper 5.01
* Located in MRQUEE.ZIP on PC-MagNet
*************************************************************
FUNCTION FRAME
PARAMETER ulrow, ulcol, lrrow, lrcol, speed
PRIVATE i, x, scr1, scr2, oldc
oldc = SETCURSOR(0)                  && Save and set cursor
x = 0
@ ulrow, ulcol TO lrrow, lrcol DOUBLE
FOR I = ulcol + 2 TO lrcol - 1 STEP 3
   @ ulrow,I SAY ' '
   @ lrrow,I SAY ' '
NEXT I
FOR I = ulrow TO lrrow STEP 2
   @ I, ulcol SAY ' '
   @ I, lrcol SAY ' '
NEXT I
SCR1 = SAVESCREEN( ulrow, ulcol, lrrow, lrcol)
@ ulrow, ulcol TO lrrow, lrcol DOUBLE
FOR I = ulcol + 1 TO lrcol - 1 STEP 3
   @ ulrow,I SAY ' '
   @ lrrow,I SAY ' '
NEXT I
FOR I = ulrow + 1 TO lrrow - 1 STEP 2
   @ I, ulcol SAY ' '
   @ I, lrcol SAY ' '
NEXT I
SCR2 = SAVESCREEN( ulrow, ulcol, lrrow, lrcol)
DO WHILE .T.
   x = INKEY()
   IF x <> 0                         && If any key was pressed
      EXIT
   ENDIF
   DELAY(speed)                      && Delay
   RESTSCREEN( ulrow, ulcol, lrrow, lrcol, scr1)
   DELAY(speed)                      && Delay
   RESTSCREEN( ulrow, ulcol, lrrow, lrcol, scr2)
   ENDDO
SETCURSOR(oldc)                      && Restore cursor
RETURN x
```

Figure 1: The FRAME() function lets you create a moving frame around a display region to draw attention to your text. You can alter the speed and style of the frame.

I changed the FRAME() function so that it saves the cursor on entry and restores it before returning. I also modified it to make use of the processor-independent DELAY() function published in Databases in the November 26, 1991, issue. To make the best use of the function, first fill the area you wish to frame with whatever text you desire and then call the FRAME() function.

To produce an animated-frame box, I used the following:

```
oclr = SETCOLOR("B/W")
@ 9,26 CLEAR TO 13,53
@11,30 SAY
   'Moving Frame Example'
x = FRAME(9, 26, 13, 53, 2)
```

The speed parameter (2) is used for DELAY() and represents timer ticks in units of 1/18 second. Increasing this number will produce a slower-moving frame.

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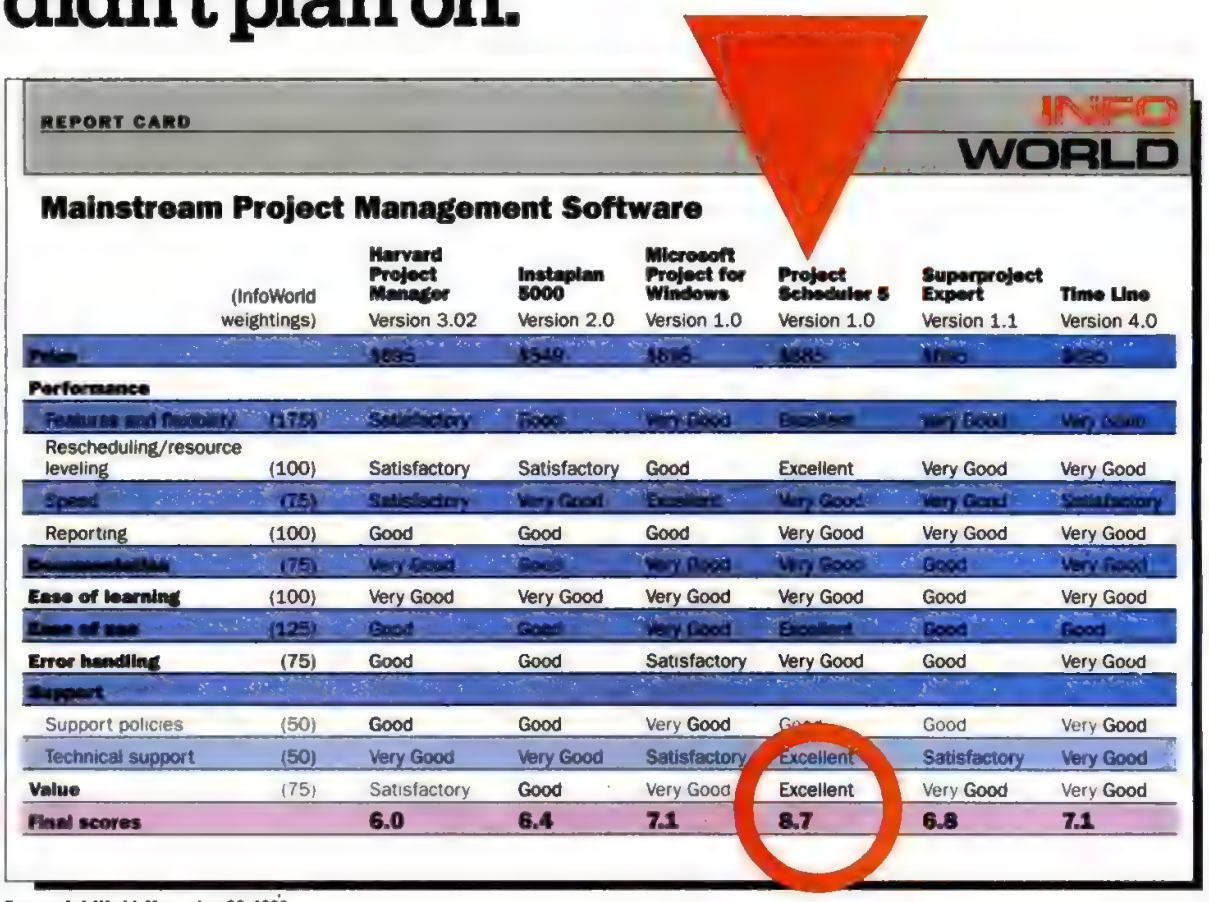

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Languages

CHECKING PRINTER STATUS

The Tutor column, May 29, 1990, discussed how to determine whether the printer was ready. That discussion provided an approach that showed whether the printer was powered on.

But a user might also want to know whether the printer is ready and selected. My PRREADY.C program (Figure 1) shows you how to accomplish this, and lets you do so for LPT 1, 2, or 3.

Dean A. Fields
Clay, New York

- **CHECKING PRINTER STATUS: PRREADY.C** determines if your printer is ready and selected.
- **HOTKEY MENUS IN QUICKBASIC:** This subroutine gives you an easy way to add a highlight bar menu to your BASIC programs.

A better way to check printer status in C is using interrupt 17h, which can return up to six different pieces of printer status information about a specific printer. So I revised Mr. Fields' printer status function in PRREADY.C to return that information, too.

The resulting PRREADY program checks for a valid printer number (1 through 3) as a command line argument, and then calls the printer status function, printer_status. This function returns a single byte that contains the printer status codes. Interrupt 17h can set up to six different bits in this byte to reflect Time Out, I/O Error, Selected-DeSelected, Out of Paper, Acknowledgment, and Not Busy conditions. The program uses a mask, 0xF9, to see if any of these bits have been set, and uses each bit to access and display the corresponding status condition. Unfortunately, because there is only limited consistency in what printers return to the printer_status call, this may not work on all printers.

Because INT 17h is implemented in the BIOS, there's no guarantee that you'll get exactly the same results using PRREADY on machines with different BIOSes. However, PRREADY should give you identical results on machines that use the same BIOS.

To use the PRREADY program, simply enter `PRREADY <num>` where *num* is a value from 1 to 3. For example, if the printer on LPT1 is powered on and available, `PRREADY 1` will produce

```
Printer 1 status: Selected Not Busy
```

You can compile PRREADY.C with the following line:

```
BCCX prready.c
```

for Borland C++ 2.0, or use

```
CL /W3 prready.c
```

for Microsoft C 5.1 or 6.0A.
—*Richard Hale Shaw*

PRREADY.C — COMPLETE LISTING

```
// prready.c -  check printer and return TRUE if ready else FALSE
#include<dos.h>  // required for prt_ready function
#include<stdio.h>  // not needed for prt_ready function
#include<stdlib.h>

unsigned char printer_status(int prt);

char *PrinterStatus[8] = // Printer Status Bits:
    {
    "Time Out",     // 0
    "",             // 1 - (Unused)
    "",             // 2 - (Unused)
    "I/O Error",    // 3
    "Selected",     // 4
    "Out of Paper", // 5
    "Acknowledged", // 6
    "Not Busy"      // 7
    };

void main(int argc, char **argv)
    {
    unsigned char status;
    int printerno,i;

    printerno = atoi(argv[1]);

    if((argc != 2) || (printerno < 1) || (printerno > 3))
        {
        printf("Usage: PRREADY <printernumber (1-3)>\n");
        exit(1);
        }

    status = printer_status(printerno);
    printf("Printer %d status: ",printerno);
    if(!(status & 0xf9))
        printf("not available");
    else
        {
        for( i = 0; i < 8; i++, status >>= 1)
            {
            if(i == 1)
                {
                status >>= 1;
                i++;
                continue;
                }
            if(status & 0x01)
                printf("%s ",PrinterStatus[i]);
            if(i == 7 && !status)
                printf("Busy");
            }
        }
    }

    // prt should be 1, 2, or 3  depending on printer to be checked
unsigned char printer_status(int prt)
    {
    union REGS regs;
regs.h.ah = 2;  // request printer status
regs.x.dx = prt-1;  // printer (0-2)
int86(0x17, &regs, &regs);

// if printer is ready status should be 0x90: Powered on,
//   Selected, Not Busy
return regs.h.ah;
}
```

Figure 1: This program, PRREADY.C, will determine if your printer is ready and selected.

MENU.BAS — COMPLETE LISTING

```
'MENU.BAS - vertical menu with hot keys

DEFINT A-Z
DECLARE SUB Menu (Row, Column, Option$(), HotKey$, Escape, Selection)

CONST TRUE = -1
CONST FG = 7, BG = 1, HiLightFG = 1, HiLightBG = 3, HotLetter = 12

DIM Main$(1 TO 10)
FOR X = 1 TO 10
  READ Main$(X)
NEXT

DATA Bill Machrone, John C. Dvorak, Jim Seymour, -, Utilities
DATA Environments, Power programming, Languages, -, Quit

Selection = 3                    'highlight choice 3 initially
CLS
CALL Menu(6, 38, Main$(), "EJI-+++-Q", LastKey, Selection)
COLOR 7, 0

LOCATE 20, 1: PRINT "Your selection was:"; Selection
PRINT "The last key pressed was ASCII"; LastKey
IF LastKey = 27 THEN PRINT "You pressed the Escape key"

SUB Menu (Row, Column, Option$(), HotKey$, Last, Selection) STATIC

  Letter = 0
  IF LEN(HotKey$) THEN Hot = TRUE
  HotKey$ = UCASE$(HotKey$)

  LMax = 0                                'Max length of options
  NumOpts = UBOUND(Option$)               'Number of options
  IF Selection = 0 OR Selection > NumOpts THEN Selection = 1

  FOR A = 1 TO NumOpts                    'Determine longest item
    B = LEN(Option$(A))
    IF B > LMax THEN LMax = B
  NEXT
  LMax = LMax + 2                         'Add two for surrounding spaces

  FOR A = 1 TO NumOpts                    'Display the choices
    COLOR FG, BG
    F = Row + A - 1
    LOCATE F, Column
    IF Option$(A) = "-" THEN
      PRINT STRING$(LMax, 196)
    ELSE
      PRINT " "; Option$(A); TAB(Column + LMax);
      IF Hot THEN
        A$ = MID$(HotKey$, A, 1)
        B = INSTR(UCASE$(Option$(A)), A$)
        IF B THEN
          COLOR HotLetter, BG
          LOCATE F, Column + B
          PRINT MID$(Option$(A), B, 1)
        END IF
      END IF
    END IF
  NEXT

  DO
    COLOR HiLightFG, HiLightBG            'Display the current item
    LOCATE Row + Selection - 1, Column
    PRINT " "; Option$(Selection); TAB(Column + LMax);
    IF Hot THEN
      A$ = MID$(HotKey$, Selection, 1)
      B = INSTR(UCASE$(Option$(Selection)), A$)
      IF B THEN
        COLOR HotLetter, HiLightBG
        LOCATE Row + Selection - 1, Column + B
        PRINT MID$(Option$(Selection), B, 1)
      END IF
    END IF
    IF Letter THEN EXIT DO
    DO
      DO
        T$ = INKEY$
      LOOP UNTIL LEN(T$)
      IF ASC(T$) = 0 THEN                 'Extended key
        T = -ASC(RIGHT$(T$, 1))
      ELSE                                'Regular key
        T = ASC(T$)
      END IF
      Last = T
      IF T = 13 OR T = 27 THEN EXIT SUB

      S = (T = 13) OR (T = 27)                    'Enter or Escape
      S = S OR (T = -72) OR (T = -80)             'Up or Down
      S = S OR (T = -71) OR (T = -79)             'Home or End
      IF T > 0 AND T <> 45 AND T <> 43 THEN       'Discard plus and minus
        Letter = INSTR(HotKey$, UCASE$(T$))
      END IF
      IF Hot THEN
        IF MID$(HotKey$, Selection, 1) = "+" AND T = 13 THEN S = 0
      END IF
    LOOP UNTIL S OR Letter
  END IF

  COLOR FG, BG
  LOCATE Row + Selection - 1, Column
  PRINT " "; Option$(Selection); TAB(Column + LMax);
  IF Hot THEN
    A$ = MID$(HotKey$, Selection, 1)
    B = INSTR(UCASE$(Option$(Selection)), A$)
    IF B THEN
      COLOR HotLetter, BG
      LOCATE Row + Selection - 1, Column + B
      PRINT MID$(Option$(Selection), B, 1)
    END IF
  END IF

  SELECT CASE T
      CASE -71                            'Home
        Selection = 1
      CASE -79                            'End
        Selection = NumOpts
      CASE -72
        Selection = Selection - 1         'Up arrow
        IF Selection = 0 THEN Selection = NumOpts
        IF MID$(Option$(Selection), 2, 1) = "-" THEN
          Selection = Selection - 1
        END IF
      CASE -80                            'Down arrow
        Selection = Selection + 1
        IF Selection > NumOpts THEN Selection = 1
        IF Option$(Selection) = "-" THEN
          Selection = Selection + 1
        END IF
      CASE ELSE
        Selection = Letter
    END SELECT
  LOOP

END SUB
```

Figure 2: This combination QuickBASIC demo and subprogram shows an effective way to create a highlight bar menu.

HOTKEY MENUS IN QUICKBASIC

Nearly every business application requires some type of menu system, where users can select an option from a series of choices. I prefer menus that allow selecting an item either by scrolling a highlight bar and pressing Enter, or pressing a designated hotkey letter. The MENU.BAS demonstration and subprogram shown in Figure 2 illustrates one way to accomplish this. Besides offering an easy way to pick an item, this menu lets you add dividing lines between logical groups of choices, and establish any item as the initial default.

The hotkey string is defined with one character for each element in the choice array, to identify which character will be highlighted. If a dash is used, a separating line is drawn for that element. A plus sign may also be used to indicate that no hotkey is to be associated with that choice. The LastKey parameter lets you know which key was last pressed in the menu, mostly to detect if the user pressed the Esc key.

Eduardo Ballesteros
Guadalajara, Mexico

This is a clever program that shows how a seemingly complex menu can be coded using only a few screens of code. Notice the use of CONST statements to define the various colors that are used throughout the MENU subprogram. Assuming you will add the MENU subroutine to programs of your own, you should be sure to include these CONST definitions in the main portion of the MENU.BAS module file.
—*Ethan Winer*

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CIRCLE 347 ON READER SERVICE CARD

PC Magazine's Direct Marketing Connection for PC Products and Services

Most of you buy PC products and services through direct marketing channels. In fact, in a recent study of subscribers, 83% said they bought PC products from direct marketers.*

You buy direct because you know exactly what you need and you seek good value and fast delivery.

The following special section connects you with the direct marketers who are eager to please you. By having them all in one place, you can quickly zero in on what you need and which vendor you want to call.

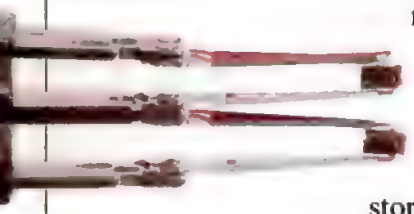
PC MAGAZINE

JUST FOR BUYERS WHO MEAN BUSINESS.

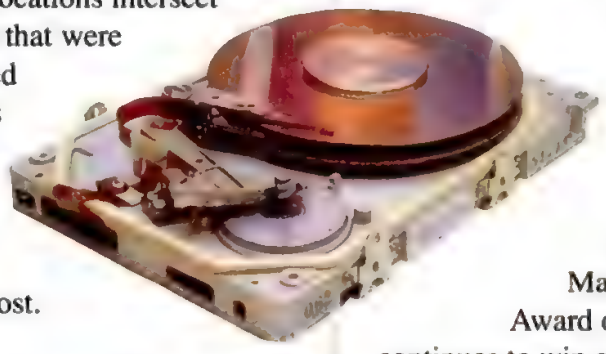
* *PC Magazine* Subscriber Study of Purchasing of PC Products through Direct Marketers, 1989.

Hard Disks Die.

Hard disk manufacturers want us to believe that hard disk technology is absolutely reliable ... but experience teaches otherwise. We depend upon data storage to be flawless, but hard disk technology isn't. Surface defects, head alignment drift, and low-level format aging cause hard disks to fail.



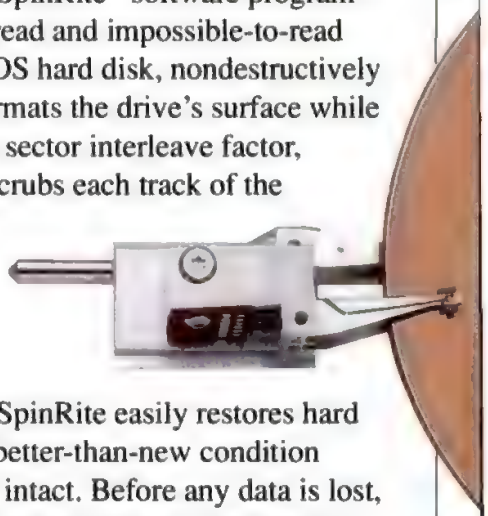
A hard disk drive's low-level format fades with use. The drive's read/write heads lose their delicate alignment and move away from the original low-level format information. These new data track locations intersect unseen surface defects that were once harmlessly located between tracks. DOS's chilling "Abort, Retry, or Fail ?" message inevitably results. Precious data is soon lost.



If left unchecked, data storage becomes more an act of hope and faith than one of science.

A return to science. The problem is known and understood, and the solution is clear. While a drive's data can still be read, the drive must be given a new, realigned and strong low-level format. Then all current surface defects must be located and managed. This process prevents hard disk data loss.

An act of prevention. Gibson Research Corporation's SpinRite™ software program reads hard-to-read and impossible-to-read data from a DOS hard disk, nondestructively low-level reformats the drive's surface while optimizing the sector interleave factor, analyzes and scrubs each track of the drive for surface defects, and relocates any endangered data to safety. SpinRite easily restores hard disk drives to better-than-new condition with their data intact. Before any data is lost, SpinRite detects that a drive is "softening" then determines and eliminates the cause. SpinRite readily recovers data that the system cannot read.



SpinRite won Byte Magazine's prestigious Award of Distinction and continues to win computer industry praise and acclaim. It has proven itself to be effective in preventing hard disk failure. SpinRite will work for you.

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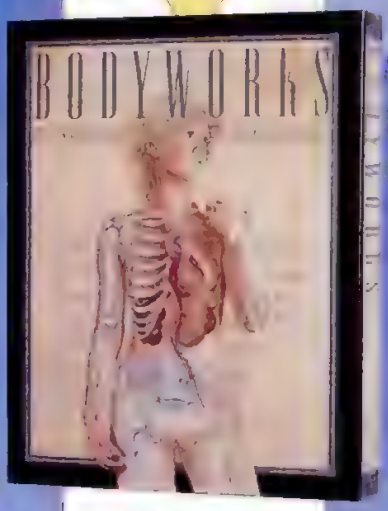

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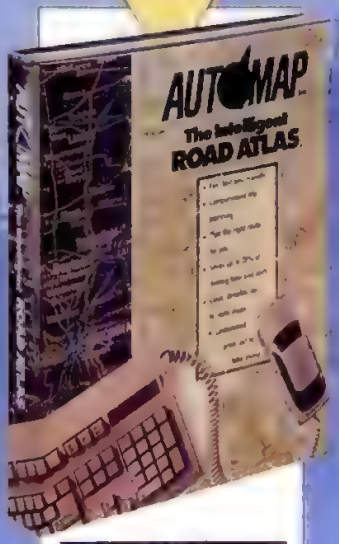

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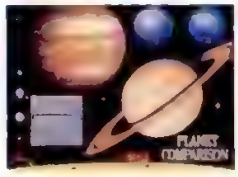

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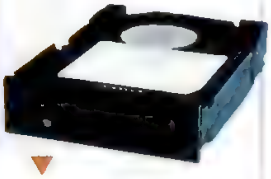

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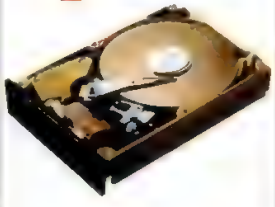

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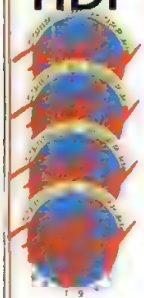

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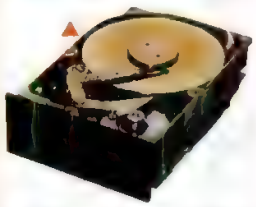

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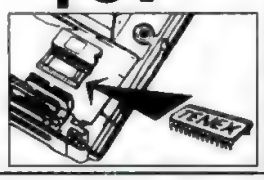

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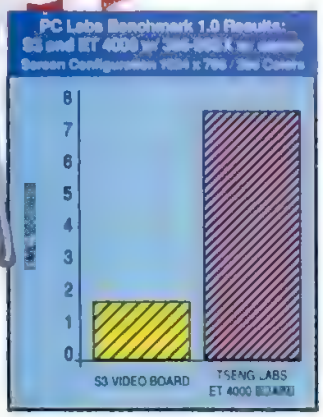

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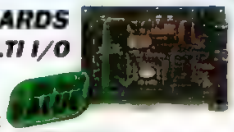

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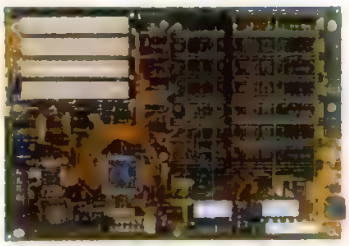

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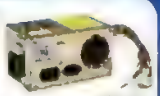

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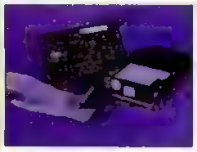

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Plus Development
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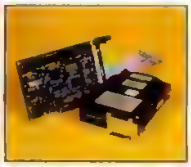

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Everex 2400B Int Modem 69

Hayes
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- Personal Modem 2400 w/ Prodigy 119
- Pocket Edition 2400 Modem 119

Intel
- Classic 2400 Modem Int / Ext 139/169
- Satisfaxtion Classic - Intl 9600 379

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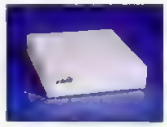

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- 9600 Sportster Int Ext 399 449
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- WorldPort 2496 Pocket Modem/Fax 309

ZOOM
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- 9624 Send/Receive Int Fax Modem 109

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FastData NE2000 16 bit 10-BaseT 109

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- Parallel/2 Serial Game Card 29
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Diamond
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- Stealth VRAM HiColor 1mb 265

Everex EGA 480 Card 69
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- KXP1124i 24 Pin 289
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- ✓ Key Tronic enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ MS-DOS 5.0.
- ✓ Full documentation.
- ✓ FCC Class B approved.

286/12	40mb	80mb	100mb	200mb
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Mono VGA	$799	$929	$999	$1,249
VGA Color	$849	$1,079	$1,149	$1,399
VGA 1024i	$999	$1,129	$1,199	$1,449

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QRAM 2.0	49
SideKick 2.0	53
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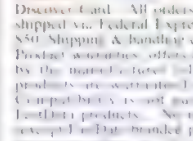

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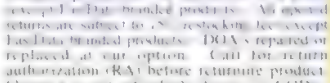

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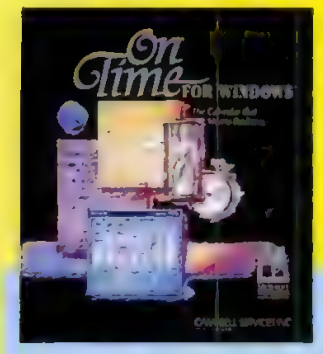

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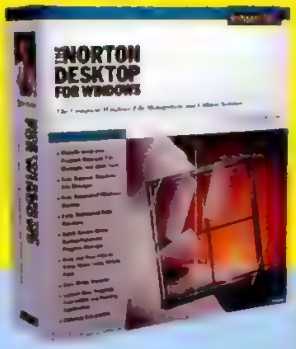

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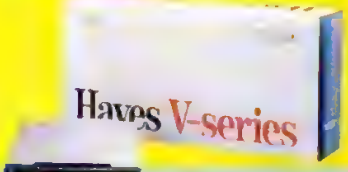

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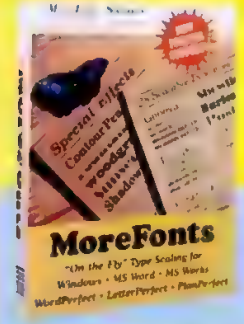

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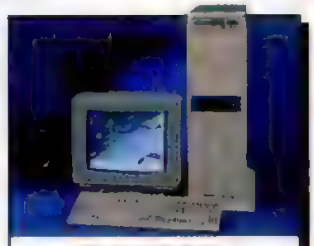

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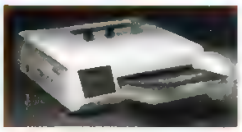

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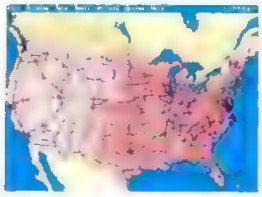

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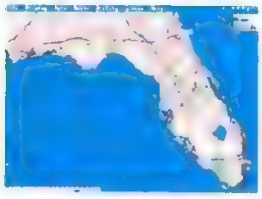

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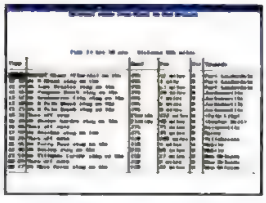

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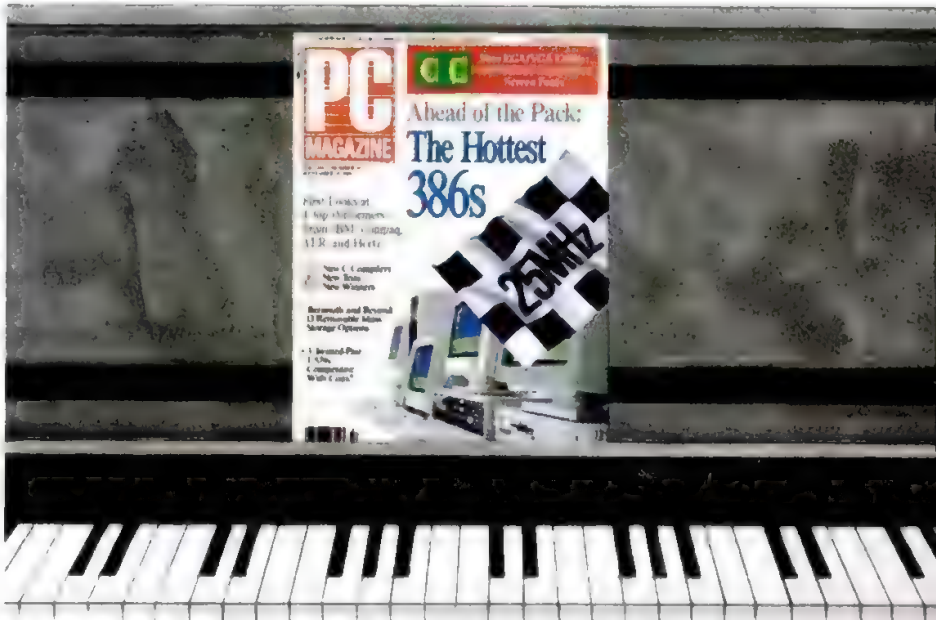

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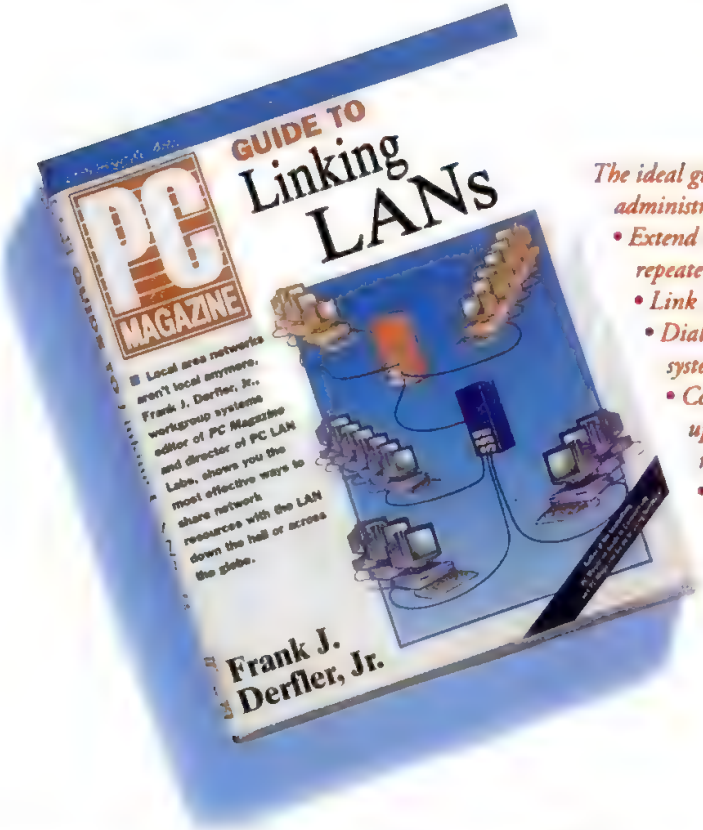

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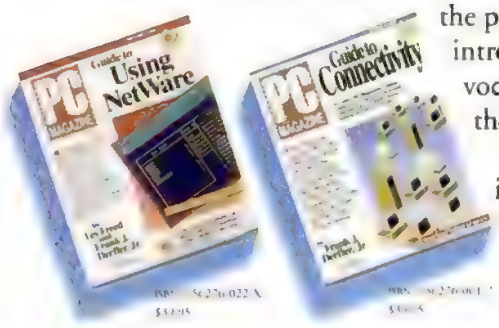

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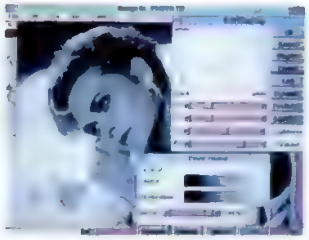

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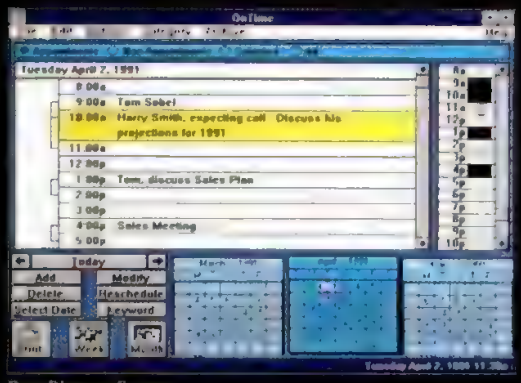

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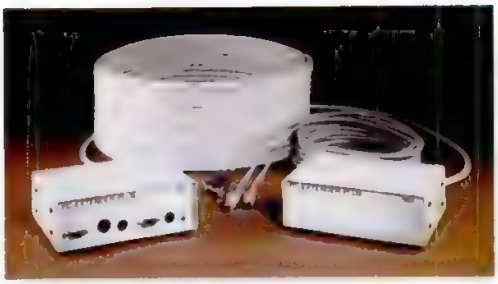

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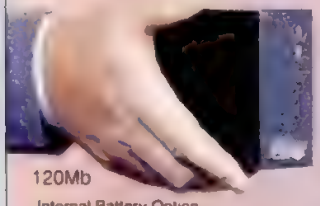

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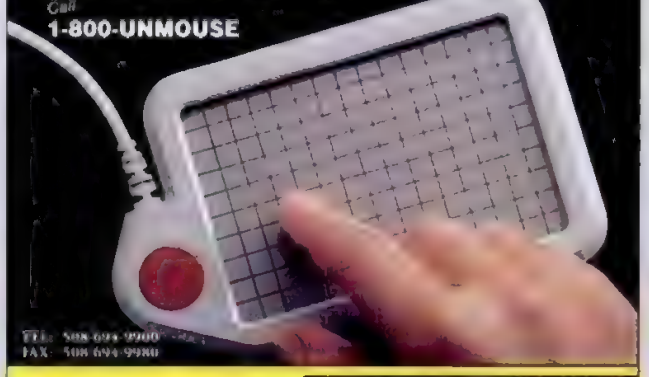

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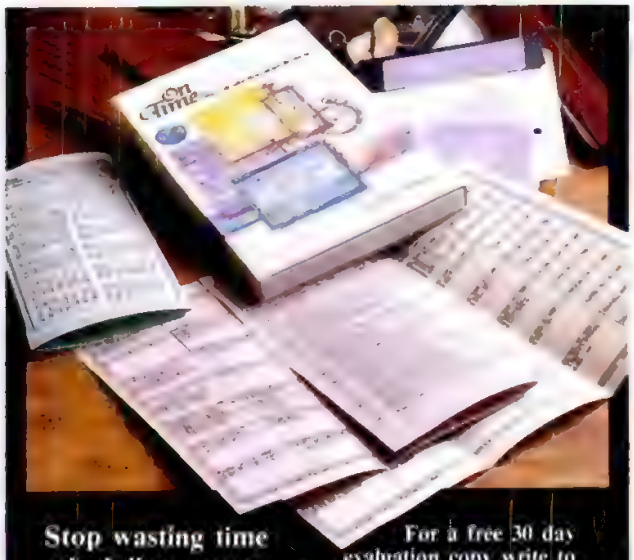
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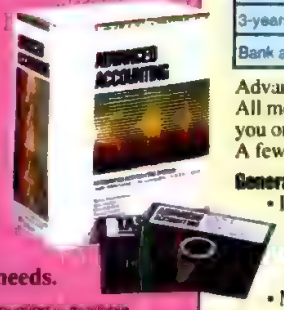

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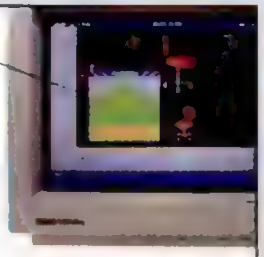

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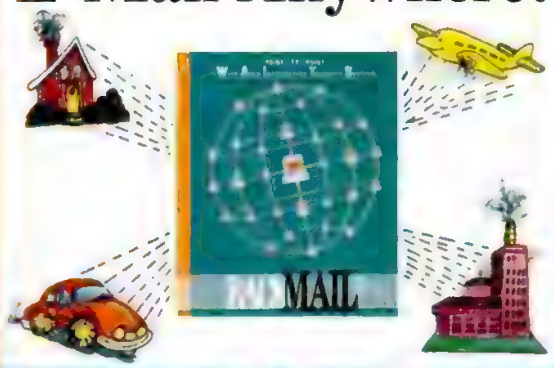

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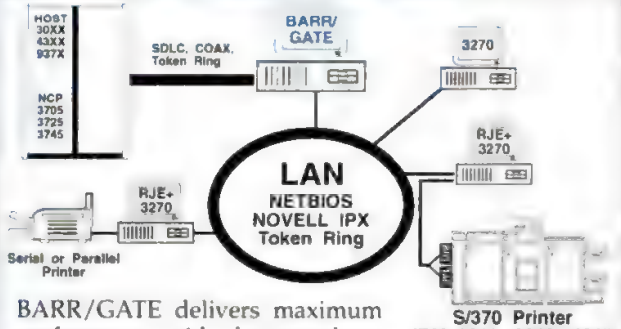

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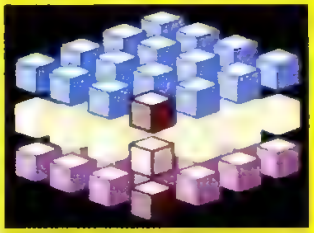

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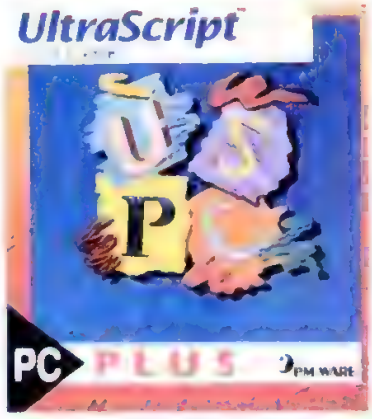

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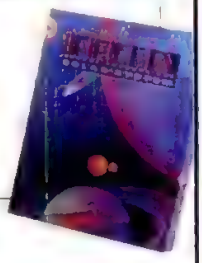

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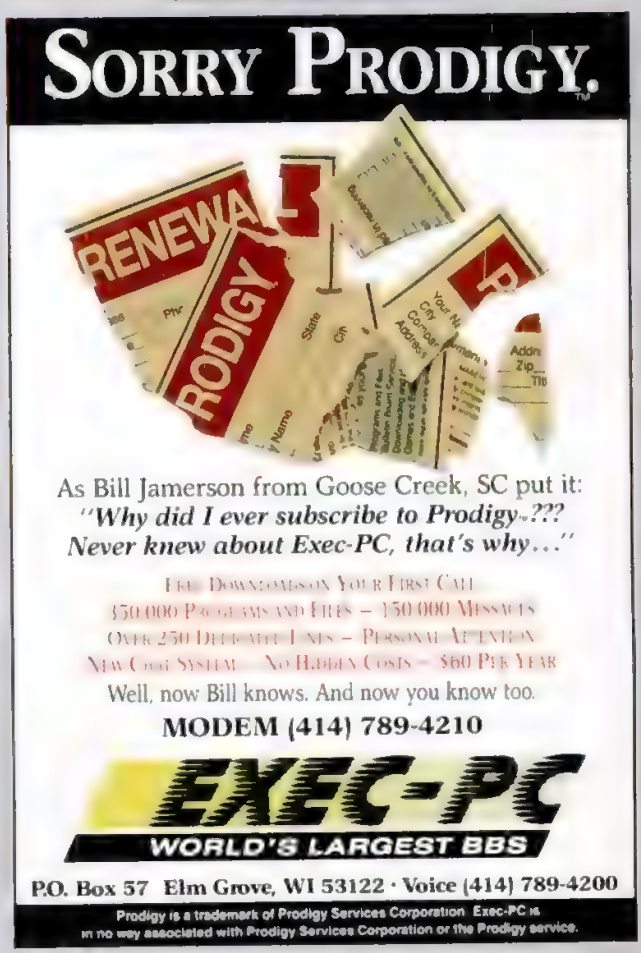

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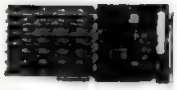

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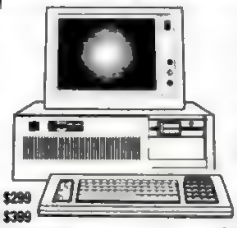

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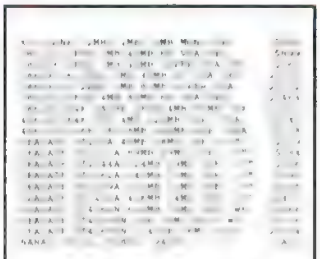

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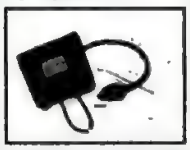

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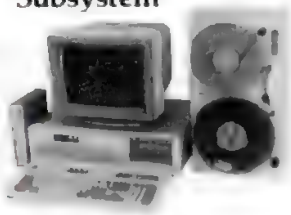

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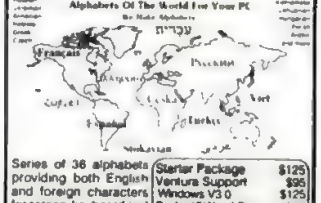

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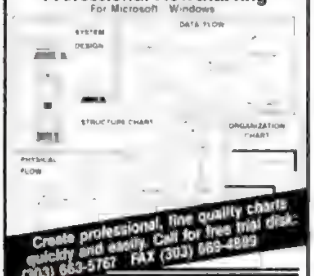

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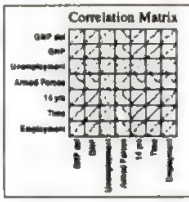

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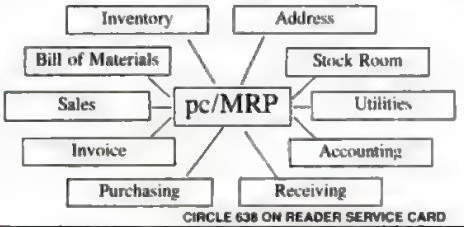

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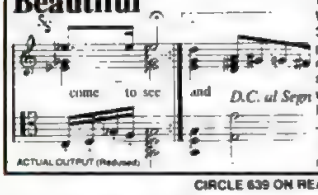

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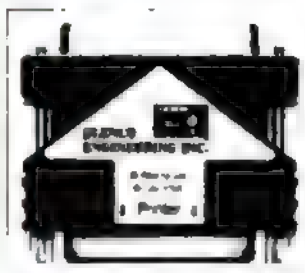

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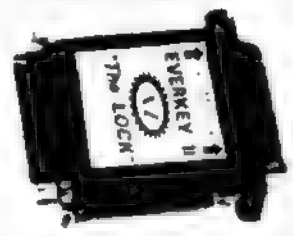

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CIRCLE 648 ON READER SERVICE CARD

Did you know...

On average, PC Magazine's direct market purchasers have spent–

- $30,000 on hardware
- $5,400 on software
- $2,100 on accessories
- an average of $2,855 per order

PC Magazine is exclusively read by over 800,000+ business buyers and brand specifiers, including computer resellers and consultants.

PC MAGAZINE CLASSIFIED

MISCELLANEOUS/BAR CODING

BAR CODE HEADQUARTERS

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PC MAGAZINE MARKETPLACE CLASSIFIED

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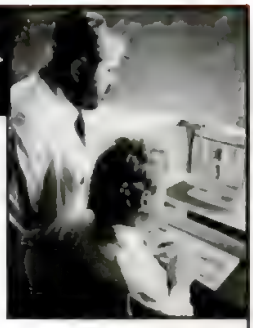

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What PC Magazine Classified is all about–

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An astounding audience of 800,000+ brand specifiers, more PC product buyers than any other publication delivers. Virtually every PC Magazine subscriber has the expertise and authority to specify brands of personal computers for their companies.

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Advertising in PC Magazine Classified works in a big way. PC Magazine's enormous scope is one reason–but there are many other big reasons why advertising campaigns succeed in PC Magazine Classified. PC Magazine Classified takes advertisers' volume sales message to the biggest audience, and supports that message in an editorial environ-ment that encourages direct response buying.

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PC Magazine Classified gets results. Advertising in PC Magazine Classified compels buyers to act, producing an average 16,462 inquiries per issue (an average 146 inquiries per advertiser per issue). Bottom line, PC Magazine Classified promotes active direct response spending, generating as much as $200 million in sales revenue through the Classified section alone.

Want to start fully utilizing this gigantic marketing tool? Call your PC Magazine Marketplace Account Representative for more information or to place your ad, 212-503-5115 or 800-825-4237.

PC MAGAZINE CLASSIFIED

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or **(800) 825-4237**

Did you know...

PC Magazine Classified generated a whopping $200 million in annual sales revenue for its advertisers, resulting in these expenditures–

- Over $52 million in applications software
- Over $52 million in computer systems
- Over $22 million in supplies
- Over $12 million in systems
- Over $61 million in peripherals
- Over $500,000 in consulting services
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In PA 215-363-2400

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Local (614) 262-0559

SAFEWARE, The Insurance Agency Inc
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PC MAGAZINE MARKETPLACE BUSINESSCARD

PC Magazine's BusinessCard section is a forum for innovative, hard-to-find and low-cost PC products and services. Ads are listed by product category and include Reader Service numbers to allow fast, easy response.

RATES:
1 issue–$600, 3 issues–$550, 6 issues–$510, 12 issues–$480, 17 issues–$460, 22 issues–$450. Multiple-ad per issue rates also available. Prepayment must accompany each insertion. VISA/MC welcomed.

AD FORMAT:
PC Magazine will design and typeset each BusinessCard ad. Advertisers should furnish typewritten copy. Ads include: 1) Headline (1 line, initial caps–30 characters max, all caps–25 characters max), 2) Descriptive copy (5 lines, 225 characters max), 3) Company name (same specifications as headline), and 4) Address and telephone number (2 lines, 40 characters per line). No logos, artwork or camera-ready ads. Publisher reserves the right to edit supplied copy to meet section specifications.

DEADLINES:
PC Magazine is published 22 times a year, (bimonthly except for July and August). The BusinessCard closing is approximately two months prior to issue date.
Please send copy and payment to: PC Magazine BusinessCard, One Park Avenue, 3rd Floor, New York, NY 10016, ATT: Richard Wortman.
For more information, call Richard Wortman at 800-825-4237 *or* 212-503-5175, FAX: 212-503-5860.

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PC Magazine Premier Windows
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PC MAGAZINE MARKETPLACE BUSINESSCARD

BUSINESS

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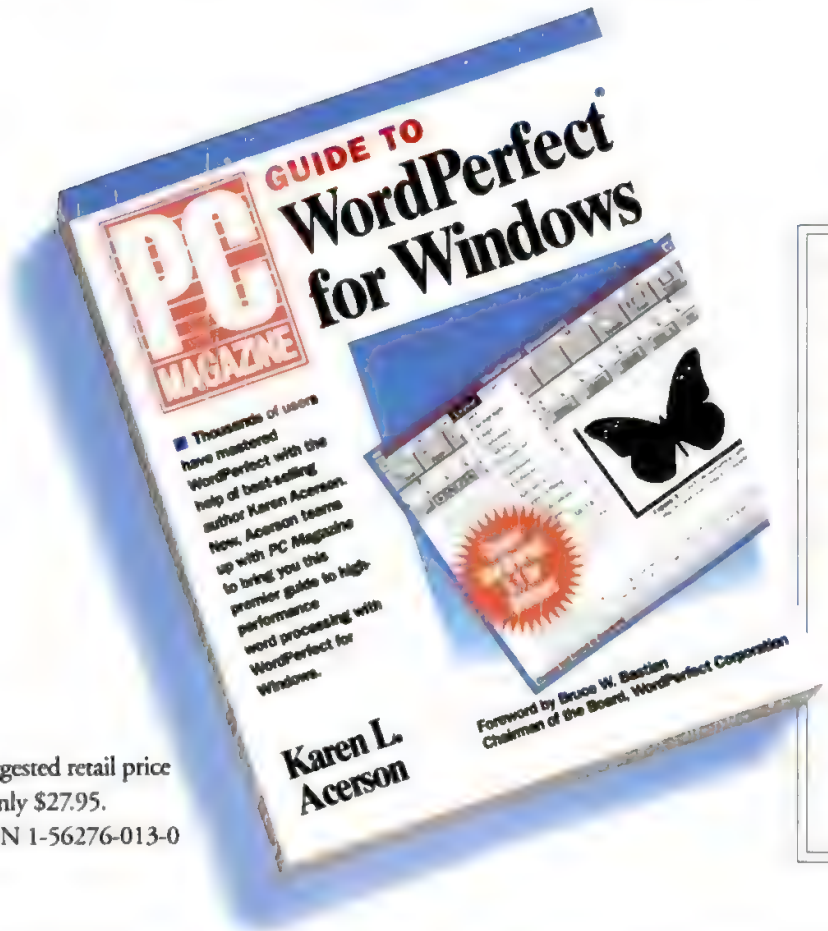

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Coming Up

■ GRAPHICAL WORD PROCESSORS

With the arrival of *Microsoft Word for Windows* 2.0 and *WordPerfect 5.1 for Windows*, the graphical word processing market is heating up. Windows users now have seven packages from which to choose. With sophisticated type control and page layout features, these programs give you access to desktop publishing functionality for your daily word processing chores. But are they fast enough? And are they easy enough to use?

■ MODEM-TO-LAN REMOTE CONTROL

Remote-control modem-to-PC software allows off-site users to use applications and gather files from the trusty office PC. The connectivity team reviews eight packages to get you right back to work once you get home. We also look at two products that promise to be contenders in the competition to provide remote control for Windows users.

■ IMAGE COMPRESSION

Here's everything you always wanted to know about image compression but didn't know who to ask. *PC Magazine*'s graphics expert Lori Grunin explains it all for you, from Audio-Video Interleave to Intel's Production Level Video, and all the standards in between. If you work with huge graphics files, don't miss this story.

■ EISA ESDI BUS-MASTERING CONTROLLERS

With the interface developments of late, serious power users may be wondering what type of controller to buy. Is it better to go with ESDI, for fast, reliable performance, or with SCSI, the apparent wave of the future? And that's not all. Power users should also consider how important caching is to their speed needs. PC Magazine Labs looks at four EISA ESDI bus-mastering controllers: two from UltraStor, and one each from Data Technology Corp. and Wyse Technology.

■ TAX SOFTWARE

Can a tax preparation program save you both time and money? Our tax attorney looks at these low-cost programs and tells you whether they're worth the time, and if they'll help you keep your tax bill low. Products reviewed will include *TurboTax*, *TaxCut 1040*, and *J.K. Lasser's Your Income Tax* software.

■ UTILITIES

Have you ever run your favorite file-finder utility only to find you have several copies of several files? Trying to decide which files to delete could easily take a few hours. SHOWDUPE, next issue's utility, can help you. Not only will it find all duplicate files, but it also lets you interactively view, compare, and delete them.

■ LAB NOTES

Next issue's Lab Notes delves into the concepts, hurdles, and benefits of coding applications in C++. It will examine the coding of SHOWDUPE—the utility in the next issue and the first *PC Magazine* utility to be written in C++—to illustrate these and other points. ■

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Dvorak Takes A Hard Look At Hardware.

This is the most exhaustive evaluation of computer hardware ever assembled. World-famous computer columnist John C. Dvorak guides you through years of accumulated data from PC Magazine Labs, the most respected product-testing center in the computer industry.

This complete buyer's guide takes the hassle out of finding the computer equipment you need. In Dvorak's no-nonsense style, you'll find in-depth discussions of everything from desktop computers to printers to modems.

Whether you're shopping for a complete system or adding to your existing equipment, you won't find a more valuable reference anywhere.

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After Hours

Products for the Leisure Side of Personal Computing

The Magnificent Ninth Goes Multimedia

by Ben Winters

What could be more delightful than spending an evening listening to Ludwig van Beethoven's Symphony No. 9 in the company of a leading authority on the man and his music? That's the opportunity afforded by Microsoft Corp.'s $79.95 *Multimedia Beethoven: The Ninth Symphony*, produced by The Voyager Co. This disk, which two years ago was an award-winning product on the Macintosh, is now available for multimedia PCs.

Robert Winter, a UCLA music professor renowned for his lectures on Beethoven and Mozart, is the guiding ear behind the disk. He selected a 1964 recording by the Vienna Philharmonic Orchestra conducted by Hans Schmidt-Isserstedt—in part for its even tempo, he says, and also for the quality of the performance. The recording runs more than an hour and can even be played on a conventional CD player.

The program's main menu is organized into five selections. "The Pocket Guide" lists the major movements and sections of the symphony. "Beethoven's World" is a 124-screen textual sketch of the composer, his work, and his times, complete with period black-and-white graphics. I particularly enjoyed the chapters comparing performances then and now; overall, the content is excellent.

"The Art of Listening" is the third selection on the menu, and it is here that Winter adds his expertise, explaining basic musical concepts using illustrations from the Ninth. For example: "*Variation* in music," Winter says, "is the repetition of an idea but with a degree of contrast." He then gives an example of two versions of the famous Joy theme. By clicking on each, even someone who is musically illiterate can discern the differences. There are 103 screens in The Art of Listening, most with musical segments to illustrate their points.

Within the section "A Close Reading," you can play the entire recording, pausing and skipping as you like. One window contains Winter's running commentary synchronized with the music. A minute and 42 seconds into the piece, for instance, the professor explains that we are hearing how Beethoven carries out a "parallel crescendo by unleashing the energy of the full orchestra." Not sure what a crescendo is? Click the glossary button and get a written definition and a listening sample.

The fifth part of *Beethoven* is a game to test your knowledge of music, the composer, and the Ninth Symphony. Up to four players can compete in answering multiple-choice questions. With the other four sections of *Multimedia Beethoven* offering such a wealth of entertainment and information, I've not felt any urge to tackle the game, even though it has a digitized voice with a "German" accent making encouraging comments.

The catch (alas, Ludwig, there is a catch) in this remarkable product is the amount of hardware and software needed to bring it off. In addition to the CD-ROM extensions to DOS, you'll need Windows 3.0 along with Microsoft's new Multimedia Extensions. You'll also need a 386-based MPC with VGA display, a fast CD-ROM drive with audio output, and a sound board (you need the new Sound Blaster Pro card if you want to hear the voice).

Multimedia Beethoven is one of those rare offerings that combines a serious product, cutting-edge technology, and real educational value to produce something that's truly a joy to use. It's not just for musicians and classical buffs. Indeed, it seems that the less you know about music, the more you'll appreciate it. **List Price:** *Multimedia Beethoven: The Ninth Symphony*, $79.95. **Requires:** Multimedia PC, Microsoft Windows 3.0, Multimedia Extensions for Microsoft Windows. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-882-8080.

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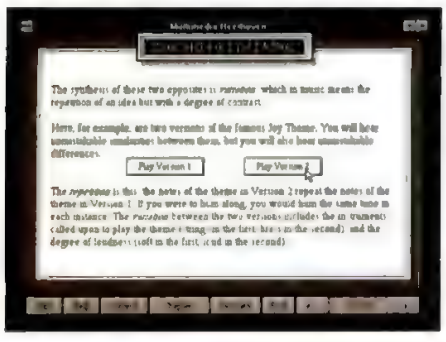

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The "Art of Listening" section of *Multimedia Beethoven* combines the knowledge of Robert Winter with CD-quality audio from Beethoven's grand opus.

▼

- **MUSIC** Voyetra's *Sequencer Plus goes Gold* Get in rhythm with Ibis Software's *RhythmAce.*
- **ASTROLOGY** Will your romance survive? See what the stars say with two new programs, *COSMO* and *LoveTies.*

Sequencer Plus Gold: Professional Features Added to a Classic

MUSIC

by Robert Kendall

Voyetra Technologies' *Sequencer Plus* has long been a dominant presence in the sequencer market, and it still holds up well against the competition. Now dubbed *Sequencer Plus Gold*, this $299.95 former Editors' Choice sports an impressive array of professional-level features and power that doesn't get in the way of ease of use.

Its unconventional menu system and dialog boxes are a little hard to get used to at first, but once mastered, they let you perform any function with a minimum of effort. You can record in real time or step-record by selecting pitches from your MIDI keyboard and durations from the PC screen. *Sequencer Plus Gold* can lay down a whopping 2,000 tracks per sequence and makes it easy to reorder, group, or sort them.

As with most sequencers, a measures screen shows each bar of your tracks for effortless

CONTINUES

Sequencer Plus Gold

CONTINUED

multitrack cutting, pasting, and global editing. The piano roll–style note editor (which shows notes graphically on a grid with vertical and horizontal axes representing pitch and time) is exceptionally intuitive. You can double-click to insert notes, move them by dragging with the left mouse button, and shorten or lengthen them by dragging with the right mouse button. It also lets you play back your piece a note at a time by repeatedly pressing the Tab key.

Global editing is very powerful, though in some ways it falls short of Twelve Tone Systems' *Cakewalk Professional*. Its major weakness: When you define sections for global editing or cut-and-paste operations, cuts must start with a first beat and end with the last beat of a measure—posing problems when sections do not begin or end at the bar line. This limitation also applies to the punch-in feature, which lets you record over a selected section.

Capabilities include globally adjusting pitches, note durations, key velocities, and MIDI controllers. The program is particularly adept at thinning out superfluous MIDI controllers that can bloat a file.

Sequencer Plus Gold also has remarkably powerful quantization options. These options let you "quantize"—that is, align misplayed notes to the nearest beat or to subdivisions of it. You can adjust the strictness of quantization in various ways, and a unique "swing" feature will put a lilt in your music by slightly delaying notes on the upbeat.

You can easily keep track of and edit controller events, which appear in the note editor beneath the music as symbols identified by event type. You display controllers one type at a time and use the Tab key to jump from event to event.

The package stores tempo changes on a separate tempo track and even lets you create multiple alternate tempo tracks for a single piece—great for trying out different possibilities. If you record a section in a rhythmically free manner, *Sequencer Plus Gold* will align the music properly with the bar lines and insert the correct tempo changes to preserve the sound of the passage—an invaluable feature.

There's a universal patch librarian, which lets you download from and upload to a wide variety of synthesizers. It even lets you renumber and rename the patches or copy them from one bank to another.

Sequencer Plus Gold is singularly adept at handling a wide variety of MIDI setups. It supports not only all standard single- and multiple-port MIDI interfaces but also the Sound Blaster and Pro AudioSpectrum audio cards. In fact, it will drive up to five sound boards at once.

Musicians who don't need the advanced features of *Sequencer Plus Gold* but want solid sequencing functionality should consider Voyetra's *Sequencer Plus Classic* for $169.95. For those who want just the basics, there's the $69.95 *Sequencer Plus Junior*.

List Price: *Sequencer Plus Gold*, Version 4.06, $299.95; *Sequencer Plus Classic*, $169.95; *Sequencer Plus Junior*, $69.95. **Requires:** 512K RAM (640K recommended), hard disk, DOS 2.0 or later, MIDI interface, synthesizer. Voyetra Technologies, 333 Fifth Ave., Pelham, NY 10803; 800-233-9377.

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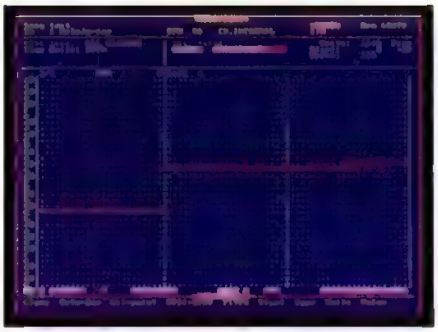

▲ In its piano roll–style note editor, *Sequencer Plus* displays controller events as letter characters beneath the music. ▼

MUSICLIPS: Plug-and-Play MIDI Sequences

A valuable alternative to recording your own sequences is purchasing them as sequence libraries. Voyetra's *MusiClips* collection of songs in Type 1 Standard MIDI format—readable by most sequencers and many multimedia programs—gives both musicians and multimedia authors a rich and relatively inexpensive source of material.

The songs are voiced for the Roland LAPC and Creative Labs Sound Blaster cards but can easily be edited for other synthesizers. Since all the music consists of noncopyrighted compositions, either in the public domain or created by Voyetra, you'll never have to pay royalties for using it.

The $149 Collector's Edition of the library contains over 150 melodies organized into categories such as Holiday, Religious, Patriotic, and Ethnic. The 31 Classical selections range from Bach inventions to the *William Tell* Overture. The arrangements are generally good, though the Classical pieces are rather poorly rendered, suffering especially from a lack of tempo inflections.

The original works are engaging pieces of mood music in various pop and jazz styles and are catalogued by descriptions such as "Sensitive and Emotional" or "Forceful and Steady." By the time you read this, four additional volumes of the library should be available for $69.95 each. The new fare will include Joplin rags, wedding music, and music evoking different national heritages.—*RK*

The Beat Goes on With RhythmAce

MUSIC by Robert Kendall

If you ain't got that swing, no software program will give it to you. But *RhythmAce*—Ibis Software's $99.95 interactive course in rhythm training—is a great tool for sharpening any musician's ear and music-reading skills.

RhythmAce's reading exercises display musical phrases on-screen and require you to tap out the correct rhythms on the PC's Shift keys, the mouse buttons, or a connected MIDI keyboard. If you really want a rhythmic workout, exercises can display two simultaneous lines that require tapping with both hands at once. Dictation exercises afford practice in the reverse skill, prompting you to notate a rhythm by clicking on the appropriate note values after the program plays a phrase for you.

RhythmAce can make do with the PC speaker, but it is a far more effective tutor with a sound board or a synthesizer connected via a Roland MPU-401–compatible interface. The optional hardware lets you hear the metronome beat while exercises are played. It also provides the only method for hearing two-handed exercises properly.

Once you've completed an exercise, *RhythmAce* plays teacher. It displays the results of dictation alongside the correct version and analyzes reading exercises quite thoroughly. If you misplayed a note, it marks that note for you—though if you missed several, it marks only the first one. A correct performance

CONTINUES

"I designed TaxCut to work with you the way I would."

—Tax Expert, Daniel Caine

TaxCut®, the award-winning tax program from MECA Software, helps you prepare an IRS-approved, professional quality tax return right on your PC, even if you're a tax or computer novice.

With its unique "Expert System" technology, TaxCut is the first and ONLY tax software to put tax expert Daniel Caine at your side every step of the way through your return. You just press the "Expert Key" any time you have a question about tax law. Or talk to the Expert whenever you need some straightforward advice about your unique tax situation. You'll get an answer in a language you're comfortable with —not IRS-ese.

You won't have to learn many new tricks to use TaxCut. It's both novice proof and flexible, so you can work the way you're most comfortable, and at your own pace. Fill in the forms line by line or work straight from your shoebox full of 1099's, W-2's and other important tax documents. If you prefer a little hand holding, TaxCut's Expert will lead you through a detailed interview process and will actually translate the answers to the forms for you.

TaxCut's powerful built-in "Auditor" is trained to audit your return just the way your own accountant would. Not only will it indicate entries which might raise a red flag with the IRS, but it recommends solutions. Then TaxCut's "Checklist" will help you research your tax situation, by tax topic, for any deductions you may have missed. TaxCut won't quit until your return is accurate.

TaxCut is complete. It contains all the forms, schedules and worksheets you're likely to need to file your 1040 tax return — over 75 in all. And TaxCut prints its own on plain, blank paper with either a dot matrix or laser printer.

Why should you trust TaxCut? Because, unlike any other tax software, ONLY TaxCut guarantees the accuracy of its calculations, and ONLY TaxCut contains the Expert HELP you need to prepare a professional quality return.

Applause for TaxCut

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— Business Week

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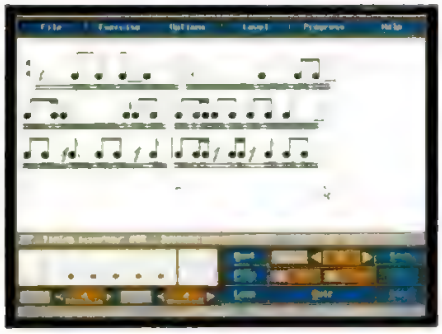
meca®

RhythmAce

CONTINUED

elicits a percentage rating of your timing accuracy. Beneath the notes you see piano roll–style graphics representations of how the rhythm should be performed and how you played it, which makes even the smallest inaccuracies glaringly apparent.

RhythmAce graphs your progress, taking into account both accuracy and the difficulty of each exercise. Twelve levels of difficulty accommodate all stages of musical development. You can further adjust the program to your abilities by specifying the number of bars and the tempo for each exercise.



▲
An interactive rhythm tutor, *RhythmAce* evaluates your performance once you have practiced an exercise.
▼

If you wish to tackle specific types of rhythmic problems, you can specify note values and time signatures for the program to use in generating exercises. Another feature lets you create your own reading exercises. This could prove invaluable for learning a tricky rhythmic passage in a piece, since the program will play the rhythm for you as well as let you practice it.

RhythmAce draws upon a library of hundreds of rhythmic patterns to build endlessly varied exercises that can encompass syncopations and double dotting. Unfortunately, it can't work with values smaller than 16th notes, and it allows no tuplets (that is, quin- or septuplets) apart from triplets. The exercises also forego the common time signatures of 9/8 and 2/2, though they include the unusual 5/4. However, when fashioning your own reading exercises, you can also create your own time signatures—even use mixed meters (alternations among different meters) and polyrhythms (different meters in each hand).

Music students should find *RhythmAce* a welcome, easy-to-follow supplement to Ibis Software's ear-training program, *Play It By Ear* (reviewed in the April 30, 1991, issue).

List Price: *RhythmAce*, $99.95.
Requires: 640K RAM, graphics display (CGA, EGA, VGA, or Hercules), DOS 2.0 or later. Sound board or MIDI synthesizer and Roland MPU-401–compatible MIDI interface recommended. Ibis Software, 625 Second St., #308, San Francisco, CA 94107; 415-546-1917.

CIRCLE 478 ON READER SERVICE CARD

Two Astrology Packages Bring Your Stars Down to Earth

ASTROLOGY
by Karen A. Carter

When the news broke that Nancy Reagan had consulted an astrologer to advise President Reagan, you may have wondered what all the fuss was about. News of Nancy's consultations brought astrology a lot of negative attention. But astrology is growing in popularity, and programs for PCs make it more accessible.

COSMO, from Cosmic Patterns, and *LoveTies*, from Permutations Software, are two new offerings that are fun, informative, and relatively inexpensive. Each is good, but in different ways.

COSMO, which retails for $98, is a simple program that is extremely easy to load and use. The package comes with three floppy disks: one each for natal charts, compatibility charts, and forecast charts. You can run the program from either the floppy disks or your hard disk.

Just type "cosmo" at the prompt and a short menu pops up that offers you a choice of Birth, Forecast, Compatibility, or Quit. After you enter the requested information for a birth chart, for example, a list appears that tells you the positions and degrees of a person's planets at birth, including the Sun sign, Moon sign, Mercury, Venus, and on through Pluto, as well as the ascendant (or "rising sign"). Summarized evaluations appear for individual charts, and they proved well written and accurate.

A minor complaint about the program is that the birth chart evaluations virtually ignore the outer planets: Saturn, Uranus, Neptune, and Pluto. While most astrologers consider these less important in birth charts than the inner planets, this seems an unnecessary omission. Another complaint is that you cannot scroll backwards in the text: once you go to the next screen, you can't refer to a previous one unless you exit and retype the chart information. There is no print facility from here, either.

Want to see how compatible you are with that new amour? *COSMO* computes compatibility charts, too, displaying your charts side by side. A written analysis also appears, which contains information under such headings as "Karen's Moon Conjunct John's Sun." The evaluations are quite good, closely matching information that is printed in some of my favorite astrology books.

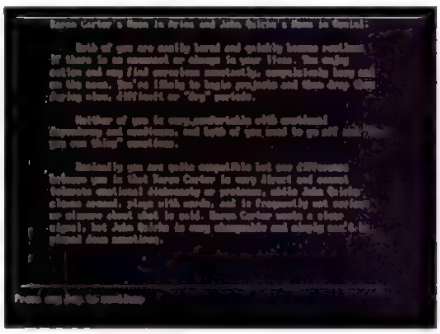
COSMO differs from most inexpensive astrology packages in that it makes monthly forecasts. The information is similar to the small blurbs that appear in your daily newspaper, but it is more accurate because the program knows your entire birth chart, not just that your Sun sign is Aries. After following several charts for a month, I found the predictions to be about 70 percent accurate.

COSMO's documentation is similar to the program itself: simple and well done. If you send in the registration card Cosmic Patterns provides with the package, you'll receive its newsletter, *Kepler News*, about twice a year.

For more serious astrologers there is *LoveTies* ($89.95), the best under-$100 astrology package I've seen. *LoveTies* also plots birth and compatibility charts, but in much greater detail than *COSMO*. It shows retrograde motion, for example. If you have an EGA-or-better screen, *LoveTies* will make you drool: Its graphics are exceptional for an astrology program!

LoveTies features a menu across the top of the screen with the categories Help, Get Data, DB Delete, Individual, Comparison, and Print. Select any heading with either keyboard or mouse and a drop-down menu appears. The program lets you store an unlimited number of charts in the database, and new databases can be created. The information for two charts can be stored on-screen simultaneously, and you can look at the charts individually or compare them. Some celebrity charts are also included for fun, such as

CONTINUES



▲
***COSMO* can compare two people's charts to show where the relationship will be strong and where problems may arise.**
▼

Astrology

CONTINUED

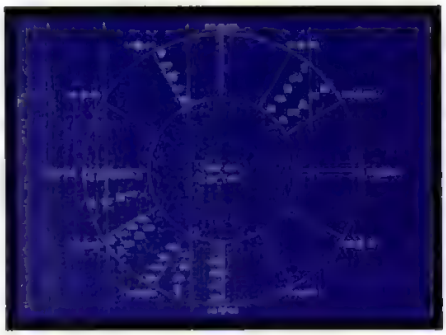
Richard Burton, James Dean, John F. Kennedy, and Marilyn Monroe (for a real hoot, do a comparison chart of the last two).

Once the information for a chart has been entered, you proceed to either the Individual or Comparison menu. Here is where most of the action occurs. Clicking on Individual brings up a submenu asking if you want to see Degrees, Aspects, the Wheel, or the Report.

Degrees gives you a list of planets and degrees similar to the one in *COSMO*, but it also adds the houses and house cusps (any astrologer past the beginner stage knows the importance of houses in a chart, which is why you'll want to find out your birth time if at all possible).

The Aspects submenu shows you the angles that the planets make to each other, and the number of degrees those angles are. Beginning astrologers may not know much about aspects, but information included in the thorough user manual will help you to understand them. The manual also includes a 37-page appendix that contains world-wide longitudes and latitudes—a must for all serious astrologers. The Wheel and Report choices give you charts in the classic astrology wheel and a written report, respectively.

Selecting the Comparison menu, you are offered four choices: Houses, Aspects, and Reports for either Chart 1 or Chart 2. The Houses category shows where the planets fall in the partner's houses; Aspects lets you see the comparative aspects between the two charts. The reports, which are worded in a way that shows they are obviously aimed at couples, are fun and well written. The two reports tell how one person's chart affects the other person; for example, the report for me has headings such as "His Jupiter in Your 1st House," and then indicates how that aspect is going to affect our relationship.



▲ ***LoveTies*** **has exceptional graphics for an astrology program. The detailed Wheel shows house cusps and retrograde motion.** ▼

Either one of these two programs would make an entertaining gift for budding astrologers (including yourself), but *LoveTies* is certainly the more complete package. So if you're one of those people who secretly sneak a peak at their horoscope in newspapers or magazines, let your PC help tell you what's in the stars for you. What you learn may surprise you. ■

List Price: *COSMO*, $98.
Requires: 256K RAM, DOS 2.0 or later. Hard disk recommended. Cosmic Patterns, P.O. Box 14605, Gainesville, FL 32604; 904-373-1504.

CIRCLE 479 ON READER SERVICE CARD

List Price: *LoveTies*, $89.95.
Requires: 330K RAM, DOS 2.0 or later, EGA or better monitor. Hard disk recommended. Permutations Software Inc., P.O. Box 499, New York, NY 10014-0499; 212-727-0457.

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Before you give to a heart organization, make sure it's one you trust: The American Heart Association. Since 1924 we've sponsored lifesaving education programs and funded $900 million in research. Others may copy us, but they can't hold a candle to our heart and torch. To learn more, contact the American Heart Association, 7320 Greenville Ave., Box 20, Dallas, TX 75231.

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American Heart Association

This space provided as a public service

by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

After the Hard Disk Crashed and Wilbur Stopped Payment on His Just-Acquired PC, Mister Ed Joined the Witness Protection Program

When the computer Jane Niskey and her husband purchased turned out to be defective, they refused to pay for it. In retaliation, the seller set up a contract bow-and-arrow killing of the Niskeys' prized appaloosa horse, Joker, according to police in Poplar Bluff, Missouri.

What a Coincidence! We've Got a Slightly Used Horse to Trade

"I have an IBM computer I want to trade for a horse."

—Classified ad, Freeport, IL *Advertiser Shopping News*, September 4, 1991

From our get-a-life (this is his biggest problem?) files: A reader who will remain anonymous writes to complain that when he bought this "10+1 Free" box of BASF floppy disks he found there were only 10 disk labels.

And Here We Thought You Had to Go Out and Buy Something More Powerful

"The power of the computer sitting on your desk doubles every two to three years."

—*Information Week*, July 22, 1991

Windows Jury Finds 3 Guilty And Acquits 5

U.S. Case in Mob Trial Meets With Skepticism

By ARNOLD H. LUBASCH

Rejecting most of ... a jury yesterday ... and ...

Headlines we'd like to see: Unfortunately, it wasn't Microsoft on trial for subjecting us to all those Unrecoverable Application Errors in Windows 3.0, but alleged mob figures involved in "the lucrative window-installation industry in New York City." *The New York Times*, October 19, 1991

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"447 AT&T 600 LPM Printer. Under constant maintenance. Excellent condition. Call for details/Make offer. (212) *xxx-xxxx*."

—Classified ad, *The Processor*, October 18, 1991

It's a hardware problem? Somebody ought to tell the Florida *Sun-Sentinel* (September 29, 1991) that OS/2 is software, and a soldering iron won't improve it one bit.

P.S. 102's Field Trip Came Suddenly: 100 Feet, Straight Up (Just After Rubbing Down The CRT on a Zero-Humidity Day)

"Helen C. Martin of Saranac Lake, N.Y., reports that the safety committee of her high school recommends wiping computer screens with a glass cleaner that is not alcohol-based, as screens in use a long time may build up static electricity, which can be ignited by the alcohol in cleaners."

—*Parade Magazine*, October 20, 1991

CARTOON RICHARD TENNANT

Mea Culpa

We goofed. So did they.

Apologies to Optical Coating Laboratory Inc. We were amazed that its Glare Guard Traveler glare shield appeared to produce single-spaced text under the filter, double-spaced outside (ARF?, September 24, 1991). Not at all, the company says. Here's the explanation: On the day of the photo shoot, no one technical was around to fire up a program that could create something on-screen, so a company rep typed in text directly and ran into the line-and-a-half DOS keyboard buffer limit that requires a carriage return before you can continue typing. Thus the choppy type looks double-spaced but isn't.

Send submissions to ARF?, PC Magazine, *One Park Ave., New York, NY 10016. Winners this issue: Howard Prestwich (horse trader), Mister X (11th diskette),* Robert J. Meyer (power doubles), *Steven Gill (constant maintenance),* Fred C. Gielow, Jr. (board-level OS/2), *Steve Rowell (screen cleaning).*

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   - ☐ UNIX® based systems
   - ☐ Notebooks
   - ☐ Other: _____
2. Are you interested in computer products for:
   ☐ Home ☐ Business ☐ Resale
3. If for resale, please identify your primary customers:
   ☐ General Business ☐ Government ☐ Education ☐ Medical
4. How many PCs does your company plan to purchase in the next twelve months?

Quantity	Timeframe	Quantity	Timeframe
_____	Less than 1 month	_____	6-12 months
_____	1-3 months	_____	More than 12 months
_____	3-6 months		

5. What do you plan to use computer products for?

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6. How many PCs do you have installed now at your company?

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7. Are you interested in leasing? ☐ Yes ☐ No AD CODE 51BR6

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   - ☐ i486™SX-based systems
   - ☐ i486-based systems
   - ☐ UNIX® based systems
   - ☐ Notebooks
   - ☐ Other: _____
2. Are you interested in computer products for:
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_____

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_____

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Zenith MastersPort 386SL—4 MB RAM and 60 MB Disk Drive	*$4,798*
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